THE METAL INDUSTRY
WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER:
ELECTRO-PLATERS REVIEW.

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THE AMERICAN BRONZE COMPANY'S NEW PLANT

An Illustrated Description of a Model Metal Shop Located at Buffalo, N. Y.

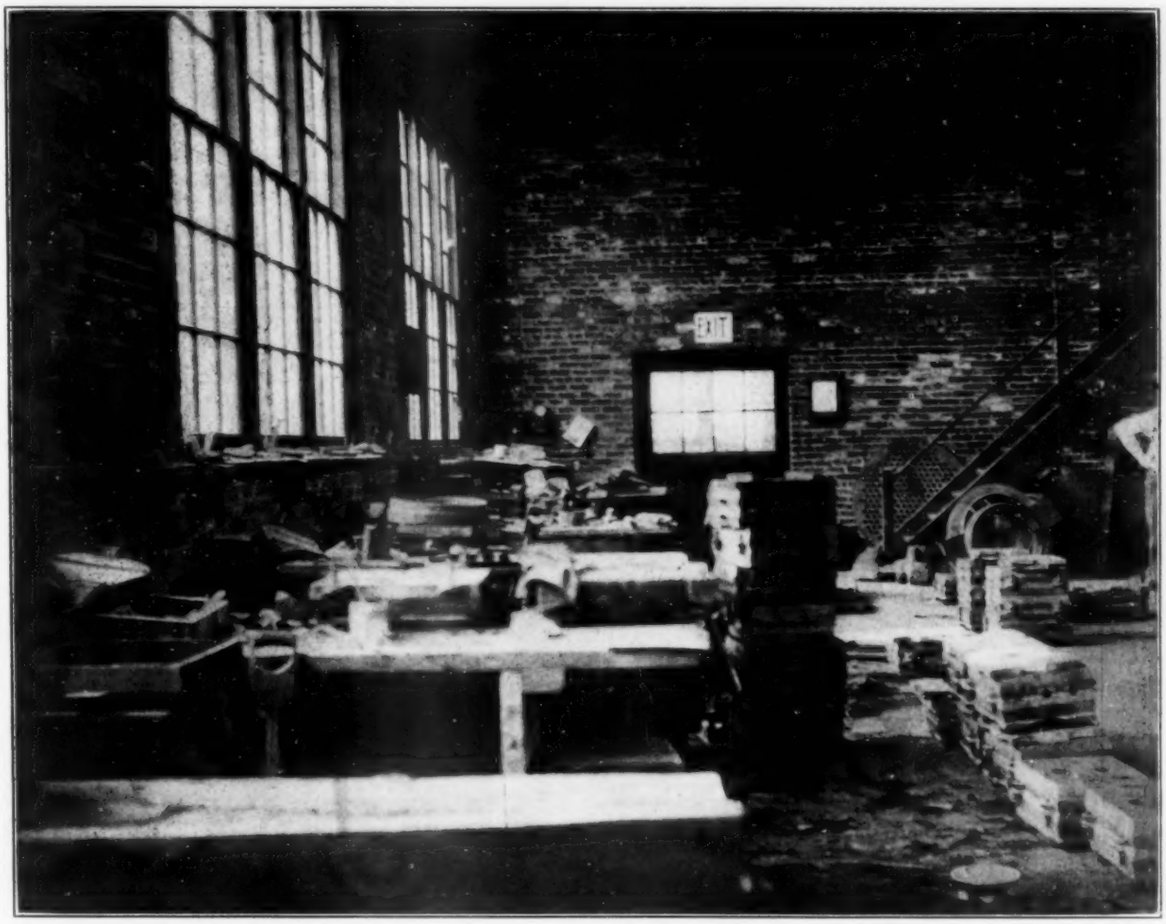
By George W. Grupp.*

The new quarters and equipment of the American Bronze Company of Buffalo, New York, which cost $25,000, was the outcome of a growing volume of business which their old plant was unable to handle. The site selected is in the northwestern part of Buffalo. It was selected because of its easy accessibility to railroad, river and canal transportation facilities, also because of the acreage adjoining their property which might be bought for future expansion.

With the site decided upon, a steel brick structure 75½ by 160 feet was constructed, three-quarters of which is a one-story building, while the balance is 60 x 36 feet and two stories high. The entire plant is well lighted by both natural and artificial means. It is well ventilated.

FOUNDRY.

The foundry is 60 x 108 feet and equipped with four batteries of furnaces, two pit furnaces to each battery. These are coke fired and natural draft and are capable of producing 8 to 9 heats per day of 2,400 pounds per heat. Each furnace has a capacity of 300 pounds per heat, in which No. 40 to 150 special crucibles may be used. Another battery of furnaces is now in the process



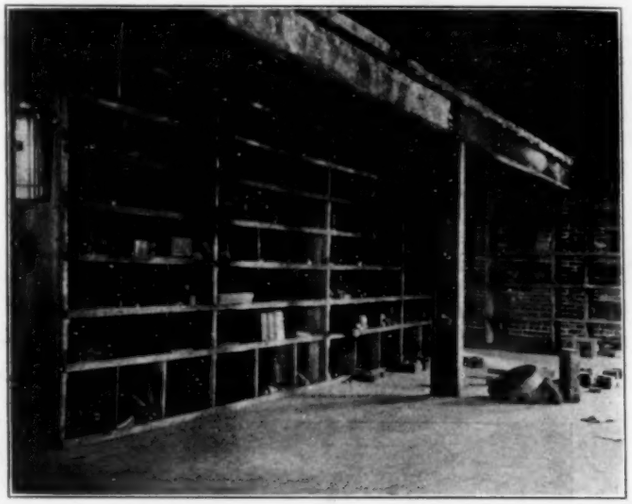
A SECTION OF THE MOULDERS BENCHES IN THE FOUNDRY OF THE AMERICAN BRONZE COMPANY'S PLANT.

*Staff of The Metal Industry.

of construction. One great advantage of these furnaces is their easy accessibility to the coke supply, which is housed directly back of the furnaces with a passage way leading from the coke storage to each battery.

In addition to this the foundry is equipped with a two-ton white metal pot, a small core oven which will hold 10 small plates, a large coke fired core oven with a capacity of 150, 12 x 18 inch plates or three 12-foot cores with a diameter up to 7 feet, and a derrick crane. Also, it is

AN EXTERIOR VIEW OF THE AMERICAN BRONZE COMPANY'S FOUNDRY, BUFFALO, N. Y.



A CORNER IN THE AMERICAN BRONZE COMPANY'S PATTERN STORAGE ROOM.

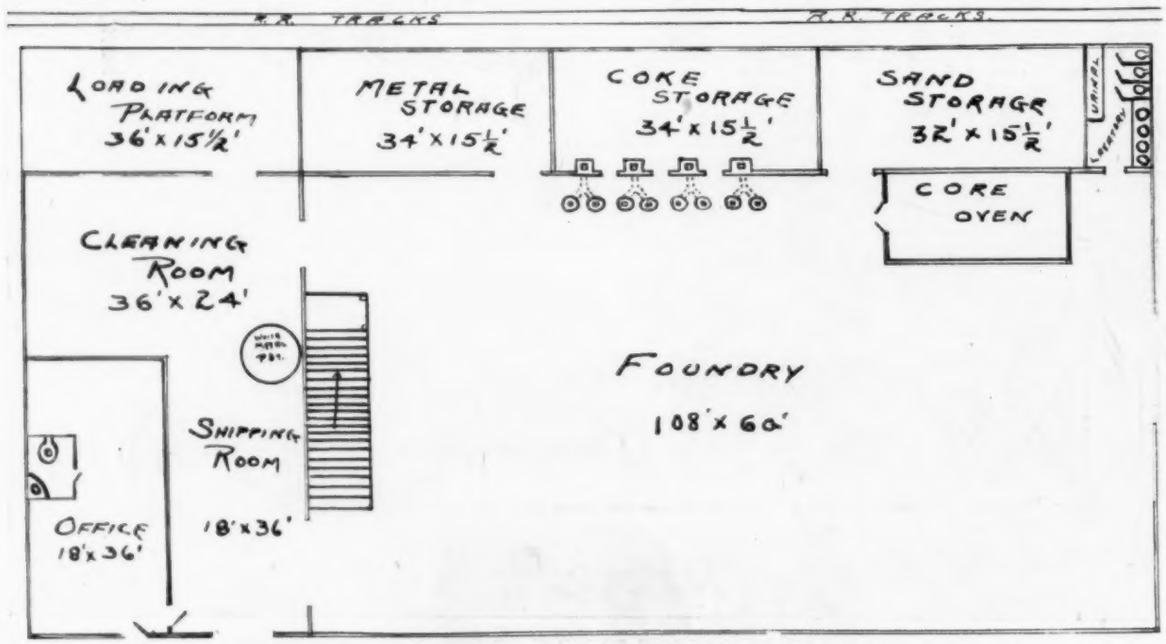
sufficiently large to care for 40 bench molders and for 24 floor molders.

SAND, COKE AND METAL STORAGE ROOMS.

The sand storage room (32 x 15½ feet) and the coke storage room (34 x 15½ feet) each have a capacity of two carloads. The latter having three openings to the foundry, each of which leads to a battery of furnaces. Two hundred tons is the capacity of the metal storage room, which is 34 x 15½ feet. Now all of these storage rooms, including the 36 x 15½ foot loading platform (used for railroad shipments), adjoin the railroad tracks. Thus it is possible to unload the metal, sand or coke directly from the cars to the various storages.

OFFICE, CLEANING AND SHIPPING ROOM.

Adjoining the foundry is the cleaning room, which is 36 x 24 feet. This department is equipped with one band saw, one band saw grinder, two sets of emery wheels, and an air compressor of sufficient power to operate 12 molding machines, bench vibrators and air chipping hammers. From here to the shipping room, which is 36 x 18 feet, is but a step. This is equipped with a five-ton platform scale. A motor truck is used by this department in making quick deliveries of local casting orders and the getting of patterns. Then not far from the foundry and immediately adjoining the shipping and



PLAN VIEW OF THE FOUNDRY OF THE AMERICAN BRONZE COMPANY, BUFFALO, N. Y.

cleaning rooms is a room 18 x 36 feet, equipped with up-to-date office furniture, which is occupied by the executive staff.

PATTERN ROOM.

The pattern room is located on the second floor and is 36 x 60 feet. All along the walls and in tiers are shelves divided into compartments. All patterns as soon as they reach the foundry are labeled and carefully filed in this room until needed.

A PART VIEW OF THE AMERICAN BRONZE COMPANY'S SHIPPING ROOM.

Note the motor truck loaded with castings. The line in the left-hand corner of the picture shows the outer edge of the scales.

As most of the work done is of a jobbing nature in brass, bronze and aluminum castings, also babbit and type metals, etc., all the work is always planned one day in advance. "The reason for this," said Charles A. Bierma, the president of the company, "is really psychological. Each afternoon we bring down from the pattern storage room the patterns which will be used the next day. Then they are assigned to various workmen, after which they experiment before going home how they can best place the patterns in a box or boxes to give the best and maximum results. Thus the workman starts to think about his next day's work.

A SMALL PORTION OF THE CLEANING ROOM IN THE AMERICAN BRONZE COMPANY'S FOUNDRY OF BUFFALO, N. Y.

CANVAS POLISHING WHEELS

THE METAL INDUSTRY lately received an inquiry from one of its readers who was having difficulty with his canvas polishing wheels. The correspondent described his trouble as being due to the failure of the glue or cement to hold together the canvas sections of which the wheels are made up. These wheels were sixteen inches in diameter with a two inch face. THE METAL INDUSTRY submitted the matter to a well known expert who is the manufacturer of polishing and buffing wheels and his answer is embodied in the following:

"We presume the wheels referred to are the ordinary type of disc canvas wheels made from heavy duck, such as are used for wagon covers, and we make these wheels in very large quantities, oftentimes hundreds and thousands at a time, as they are very extensively used in certain lines of work.

"We have had a great deal of difficulty in gluing these canvas wheels together so that they would hold and, of course, have worked out a process which is very satisfactory and gives little or no trouble, but the difficulties are these, viz.:

"In using new canvas unless the people putting them together are prepared with all the apparatus necessary, they will apply the glue to the canvas in the usual way and pile layers up one upon another and very likely put them under a press to squeeze them together, and the trouble lies in the fact that the canvas soaks up the glue so quickly that it is difficult, without a suitable apparatus, to get them under the press quick enough and before the glue has so soaked down into the canvas that there is little or none left on the surface for adhesion.

It will be appreciated that this coarse canvas is very rough on the surface, being full of what we call "Hills and Valleys," and inasmuch as the high spots of one sheet touch the high spots on the sheet next to it, it will be seen that there is quite a trick involved to get the canvas under such pressure quick enough after the glue is applied so that there will be sufficient contact of one sheet with another to give a holding body.

"Then there is the question of glue. Our experience is that it requires a glue of a special character for this work, and the glue must be of a high quality at a price of not less than 17 to 20 cents a pound, in order to have the strength to withstand the pressure of the wheel which tends to split the layers apart, and usually the glue must be treated to a certain formula to give it the necessary body.

In the case of second-hand canvas, which is more commonly used in polishing wheels than new canvas, we find from experience that second-hand canvas is usually covered with various substances, one class of canvas coming from mills of a certain character is covered with a sulphide which is invisible to the eye and which has a very detrimental action upon contact with glue, and other classes of material having been used for various purposes are sometimes coated with substances, so that the glue does not soak through this coating and penetrate the fabric itself.

"Now in relation to the heat of the work for the wheel, this has nothing to do with it. There is not sufficient heat generated in a canvas wheel of this character to have any effect whatever on the glue, in fact, cotton is a naturally cold substance and does not retain heat, and if sufficient heat would generate on the face of the wheel to affect the glue, the naturally cold condition of the cotton would prevent the heat penetrating the wheel to any depth and certainly not enough to affect the adhesion of the layers of fabric.

"These canvas wheels are made by the manufacturers in several ways. If a rock hard wheel is desired, each layer of canvas is glued to the next one, but if the wheels of some cushion of flexibility are desired, the flexibility is regulated by sewing one, two, three, four or more layers in "Sections" and then these sections are glued together. Oftentimes users of large wheels, such as plow manufacturers, demand that they be hand-sewed through and through for additional strength, but, as a matter of fact, any hand-sewing process used in addition to the glueing adds nothing whatever to the strength.

"The question of whether or not the wheels should be sewed or cemented, is entirely one of the type of wheel required—whether a hard one of a soft one is needed for the work."

Utica, N. Y. DIVINE BROTHERS,
By B. H. Divine.

GRINDING WHEELS*

An Article Giving the History and Description of Various Abrasive Compounds.

By Walter C. Gold†

INTRODUCTION.

The word abrasive comes from the Latin word Rado, to grind.

Previous to the advent of the grinding wheel made from artificial or natural abrasives, manufacturers were dependent upon the grindstone which is a natural quarried stone. Castings were then chipped and filed—a most laborious operation. The grinding wheel industry has become one of marked importance, practically all the vitrified wheels used in the world being made in this country. When I first became affiliated with the grinding wheel business in 1890, emery wheels only were manufactured. Today, it is the artificial abrasives which have been adopted by the leading wheel makers. The improvement in the business has been of a marked character, not only in the method of manufacture, the betterment of quality, but in a vast extension of character of work. Grinding wheels today are used for classes of grinding which ten years ago was considered impracticable. In this necessarily brief paper I want to cover these points:

1—Raw materials.
2—Methods or processes of manufacture.
3—A bit of history.
4—Conclusion.

MATERIALS.

The principal materials are of two kinds—the natural and the artificial. The natural abrasives comprise "Naxos" emery and corundum. The artificial abrasives include the carbide of silicon and the artificial corundum. In the former are to be listed "carborundum," "crystolon" and "Carbolon." The latter comprises "boro-carbone," "alundum" and "aloxite."

NATURAL ABRASIVES.

In 1890, practically all wheel makers were using Turkish emery from Asia Minor. Turkish emery is now used only for polishing purposes. It contains anywhere from 15 to 25 per cent. oxide of iron (the larger the percentage of oxide of iron the softer is the emery). Turkish emery has a good fracture and is just tough enough to make it ideal for polishing purposes. The emery is imported from Asia Minor—Turkey in Asia. Owing to the European War, all Turkish ports, from which Turkish ore is shipped, are closed. The consequence is there is a famine on of this commodity in this country and two of the largest emery mills have been compelled to shut down owing to lack of ore. If this condition prevails much longer American emery, which contains 45 *per cent.* oxide of iron, will have to be used as a substitute on hard work as well as on soft. Some excellent native ore was mined at Chester, Mass., but outside that deposit American emery was, and still is, absolutely unfitted for manufacturing wheels, principally on account of its large percentage of iron oxide (about 45 per cent). The principal grains used in the manufacture of grinding wheels are 12, 16, 20, 24, 30, 36, 46, 54, 60, 70, 80, 90, 100, 120 and 150. The numbers are determined by the mesh or number of holes to the linear inch in the bolting cloth. By grade is meant the degree of hardness, some makers using certain letters of the alphabet and the balance use figures. Thus a wheel labeled 36-0 means that it is made of grain number 36 and grade 0—two grades harder than medium which is represented by the letter M when the alphabet is used. The corresponding grade in the figure system would be 3¼ or 3½.

The "Naxos" brand of emery is imported from the island of Naxos (Grecian Archipelago), Greece, the mines being controlled by the Grecian government. "Naxos" emery contains a large percentage of alumina (about 65%). This emery has a most excellent fracture, the grains being very hard and very sharp, and therefore especially adapted for use in grinding wheels. The "Naxos" emery came into use in 1892 and for some years was the best material for manufacturing grinding wheels. Owing to the European War, very little "Naxos" ore is being received.

Corundum (oxide of alumina or clay) was used for many years and is yet used to some extent; but owing to the use of the artificial corundum it is rapidly disappearing as a grinding factor. Some very fine corundum called sapphire or blue corundum was mined until 1893 at Unionville, Chester County, Pa., but being found in "pockets" only the mines became too expensive to operate. Emery, corundum and artificial corundum are oxides of the metal aluminum and have the common formula AL_2O_3, but they only have this formula when they are of *crystalline* formation and not when in the amorphous or non-crystalline state. Alumina is aluminum oxide of the *amorphous* variety—not crystalline. It is not an abrasive until the amorphous condition becomes crystalline.

ARTIFICIAL ABRASIVES THE SILICON CARBIDES.

The first artificial abrasive was "carborundum" or carbide of silicon. The Carborundum Company was chartered and began business October 1, 1891 at Niagara Falls, New York. The patents on "carborundum" expired a few years ago. "Carborundum" is produced from a mixture consisting of coke, salt, sand and sawdust treated in electrical furnaces. It is especially adapted for grinding metals of a low tensile strength, such as cast iron, brass and pearl.

"Crystolon" was first made by the Norton Company at its plant at Chippawa, Ontario, Canada in July, 1910. It is similar to "carborundum" (Carbide of Silicon) and, like "carborundum" is especially adapted for grinding meals of low tensile strength.

"Carbolon," also carbide of silicon, is similar to the other three materials above named. The manufacturers, however, state that it is acid treated for 62 hours, after which it is water washed for 30 hours, thereby removing all surface iron and graphite. It is manufactured by the Exelon Company at Thorold, Canada, crushed, graded and shipped from Blasdell, N. Y. "Carbolon" is the most recent of the silicon carbides, having been placed upon the market this year.

ARTIFICIAL ABRASIVES OR ALUMINOUS OXIDES ARTIFICIAL CORUNDUM.

Natural corundum is found imbedded with its associates to such an extent that in the largest and principal deposit, located in the Province of Ontario, Canada, only eight per cent was pure corundum. All the following artificial corundums are especially adapted for grinding metals of high tensile strength, such as wrought iron, tempered steel, etc. Artificial corundums are practically pure and for that reason are better adapted than natural corundum in the manufacture of grinding wheels. Owing to the intense heat (about 2500 degs. F) to which vitrified wheels are subjected, the grinding materials cannot be too pure. Predetermination of grades, or degrees of hard-

*Of the firm of Walter C. Gold, Philadelphia, Pa.
† Address before Rotary Club of Philadelphia, Pa., November 3, 1915.

ness of wheels can not only be more accurately determined, but loss from flaws and check cracks is greatly reduced. There is, also, a better fracture to the material and a uniformity of product simply impossible to obtain with the natural abrasives. These artificial abrasives are made from Bauxite, in electrical furnaces.

The Norton Company of Worcester, Mass, in 1906 abandoned the use of emery entirely and adopted its new artificial abrasive which they call "Alundum" and which is manufactured at Niagara Falls, N. Y., and shipped to Worcester, Mass., where it is made into grinding wheels and rubbing bricks.

"Aloxite" is the name given by the Carborundum Company to its artificial corundum and was placed upon the market in the summer of 1909.

"Boro-Carbone" is made in Southern France, where an immense deposit of bauxite (the richest oxide of alumina) exists and is shipped to the Abrasive Material Company at Philadelphia, Pa., where it is manufactured into grinding wheels and rubbing bricks. It was placed upon the market by the Abrasive Material company in 1913. Grinding wheels made from boro-carbone show a surprisingly high tensile strength and great cutting powers.

PROCESS OF MANUFACTURE.

There are three principal processes of manufacture —the vitrified, the silicate and elastic or shellac.

THE VITRIFIED PROCESS.

Briefly stated, the method of manufacture is as follows: The grains are mixed with water and the clays and other ingredients which comprise the "bond." After thoroughly incorporating the grains with the "bond" (and the amount of "bond" used, and its character, determines the grade or degree of hardness) the wheels are placed upon a plaster-of-paris bat, and then placed in the dry-room, where they remain subjected to dry steam heat for from a week to ten days, the size of the wheel affecting the length of time needed to "dry out" the wheels until they assume the consistency of hard clay. They are then placed upon a potter's wheel and shaved to size and shape. After again being placed in the dry-room for a few days, they are ready for the kiln. Here the wheels remain for about four days subjected to a heat reaching 2500 degs. F. After being extracted from the kiln, they are mounted on machines and tested for balance and turned off on sides and face; bushed with a lead hole and placed in the testing machine, where they are speeded up to a point about 9,000 surface feet per minute. Should there be a hidden check-crack or flaw, such defect would manifest itself in the testing machine, and the wheel burst there; but having withstood the terrific stress or strain of nine thousand peripheral or surface feet per minute, it is assumed that the wheels are faultless and are ready for shipment. In the vitrified process the wheels are not tamped or pressed, and after being subjected to the intense heat of the kiln, are porous and open in texture and will not, therefore, heat or burn the work when the proper grade is furnished. The process also renders the wheels waterproof—[illegible]r and other liquids having no effect whatever—[illegible]heels working equally well wet or dry. Fully 75 p[illegible]ent. of all grinding wheels made are by the vitrified process.

THE SILICATE PROCESS.

All grinding wheels over 30 inches diameter and, too, some smaller wheels for certain classes of grinding such as tool grinding, knife sharpening and surface grinding are made by the silicate process. They are tamped firmly (after being thoroughly machine mixed) into moulds and then placed in especially built ovens at a comparatively low heat. This process requires but a few days as the bond sets quickly and prompt delivery can, therefore, be effected. Where a wire web insertion is required this process of manufacture is used, it producing a "closer-bonded" grinding wheel.

THE ELASTIC PROCESS.

In the manufacture of thin wheels, especially where the diameter is relatively large, the elastic or shellac process is used. All are made in moulds, the larger wheels being heavily pressed. As with the silicate wheels they are subjected to a comparatively low heat. The wheels are (as the name suggests) elastic to a marked degree; will stand considerable side pressure and wheel makers thereby are enabled to produce wheels as thin as 1/16-inch in 8-inch diameter and 1/8-inch by 12 inches.

HISTORY OF THE WHEEL BUSINESS.

The first record relating to solid grinding wheels were made in a paper read before the Society of Arts, London, England, March 20, 1878. It was read by Arthur H. Bateman, F. C. S., a grinding wheel manufacturer. He credited Henry Barclay, an Englishman, with conceiving a solid wheel made from emery in the year 1842. Barclay patented his process, but Bateman credited Americans with a successful prosecution of the industry.

In the year 1873, Frank B. Norton and Frederick Hancock were manufacturing stoneware at Worcester, Mass. Associating with them was Swen Pulson, a native of Sweden, now a resident of West Philadelphia. Pulson experimented and produced an emery wheel through vitrification, using certain clays as a "bond" or binding material for the grains. This type of wheel is also called a "puddle" wheel, owing to its initial method of manufacture. Thus was born the vitrified emery wheel which was destined to revolutionize the grinding wheel business. The Norton Emery Wheel Company (now the Norton Company) of Worcester, Mass., was named in honor of Mr. Norton, from whom the business was purchased in 1885.

In the year 1872, Gilbert Hart at Detroit, Michigan, an ex-Union sharpshooter in the Civil War, placed upon the market the first silicate grinding wheel. At the close of the war, Mr. Hart went West and located in Detroit. At the suggestion of a Mr. Page, then superintendent of the Detroit Safe Company, Mr. Hart commenced experimenting with emery wheels, using silicate of soda as a bond. It was a success, but several having broken in use, Hart looked around for a medium for strengthening his wheels. He hit upon the idea of using a brass wire web, which he inserted into the wheels while in a plastic state. Mr. Hart applied for a patent and it was granted. The wire web, of course, cannot be used in a vitrified wheel, as the intense heat would melt the metal. The inventor of the elastic or shellac wheel is Henry Richardson of the Waltham Grinding Wheel Company, Waltham, Mass.

There are today 30 plants, large and small, manufacturing grinding wheels in the United States and Canada. The leading seven makers are:

Organized

1894 The Abrasive Material Company, Philadelphia.

1896 The American Emery Wheel Works, Providence, R. I.

1891 The Carborundum Company, Niagara Falls, N. Y.
1872 The Detroit Grinding Wheel Company, Detroit, Mich.
1885 The Norton Company, Worcester, Mass.
1893 The Safety Emery Wheel Company, Springfield, Ohio.

CONCLUSION.

As before stated, it is the day of the artificial abrasive. Emery, though still used to some extent, has been pushed into the background and the carbide of silicons and aluminous oxides of clay or bauxite have come to the fore. This transition has taken place within a quarter century and much of it within the last decade. The grinding wheel business has become an important industry of our country.

So indispensable have grinding wheels become in the realm of manufacturing, that many consumers have stated that they would be low-priced even if sold at list prices only. There is no tool about the shop which gives such service in proportion to its cost! Their use has vastly increased during the last decade, and the prospects for the future are very promising. Wheels are now being used for an ever increasing variety of grinding, simply because the business has been placed by its pioneers upon a commercial and scientific basis. These improvements during twenty-five years especially may be noted: the use of the electric pyrometer, accurately indicating the heat of the kiln while in process of "burning" (before that instrument was used, the kiln burner had to depend upon his own judgment as to when to draw the fires and allow the kiln to cool off); the use of the testing machine by the leading makers (wheels are no longer being shipped out without being tested in the especially built testing machines, and accidents are consequently very much fewer—they have been reduced to the minimum); the predetermination of grades or degree of hardness through the amount of "bond" or binding material worked into each wheel. (The more "bond" worked into a wheel, the harder it comes from the kiln and, necessarily, the stronger); the experience gained in the selection of grains and grades has enabled manufacturers to select wheels for the great and increasing variety of work with such accuracy that the number returned for every reason whatsoever is exceedingly small; owing to the higher and more uniform quality of grinding materials used. The personnel of the salesman, too, has much improved—experience proving that men must have a technical knowledge of wheel manufacturing in order to successfully sell them.

Manufacturers of today could hardly dispense with these "revolving files," for that is practically what they are; and it is interesting to note, in conclusion, that the best grinding wheels used in Europe are manufactured in this country, and that Philadelphia exports a great many grinding wheels.

BRASS FOUNDRY EQUIPMENT AND MANAGEMENT

SOME COMMON SENSE REMARKS BY AN EXPERT FOR THE BENEFIT OF THE TRADE.

BY W. H. PARRY.*

(Concluded from May.)

PARTING COMPOUNDS.

Last, but not least, we will consider that ever present help to the molder and without which all molding machine operators are lost. We refer to the various makes of parting compound which, to the uninitiated, means a dry lubricant that is very freely sprinkled on patterns both of wood and metal to prevent the sand from adhering to them.

Years ago we used to buy a material known as "lycopodium" which in plain English is the pollen of the plant known as the ground pine. It was sold at very fancy prices in and around a dollar a pound and the bulk of it came from Russia, where the serfs gathered it at the rate of a pound a week and got fat doing it. The price, however, was prohibitive notwithstanding its wonderful value as a pattern lubricant.

The next step then was to find a substitute and we United States fellows were the boys that did that little thing. Various minerals were pulverized and tried in the hope that they would take the place of "lycopodium," but it was some time before our fellows discovered that while their stuff was slippery when dry, it formed a paste when it came in contact with the damp molding sand and defeated the very object they were seeking to obtain. This little weakness of their dope did not deter them, however, from sticking a lot of us easy marks on the sale of barrel lots, but in their somewhat blind groping for something better they eventually found deposits of tripoli in this glorious country of ours. Their troubles were then over, but not that of their customers for when they realized that they had at last found a fair substitute for "lycopodium" they started on a price jockeying campaign that had everybody tired in the long run. At first forty cents per pound was charged for these substitutes, while now we buy them at from 2½ to 3½ cents per pound.

They are not all good compounds, but the most of them are and to attempt to run a brass foundry in these days of rapid production without the help of a pattern and sand lubricant is to invite disaster. The stuff is usually placed in a bag of loosely woven cotton and is sprinkled on the pattern just before the sand is rammed around it and if any man or "suffragette" can invent a method that will prevent molders and molding machine operators from shaking about ninety per cent. of the stuff in the air and ten per cent. on the pattern, then I would like to know his or her address and we will both make more money than the ammunition manufacturers are making now.

(The end.)

*Superintendent National Meter Company, Brooklyn, N. Y.

SPELTER PRODUCTION FOR THE FIRST SIX MONTHS OF 1915.

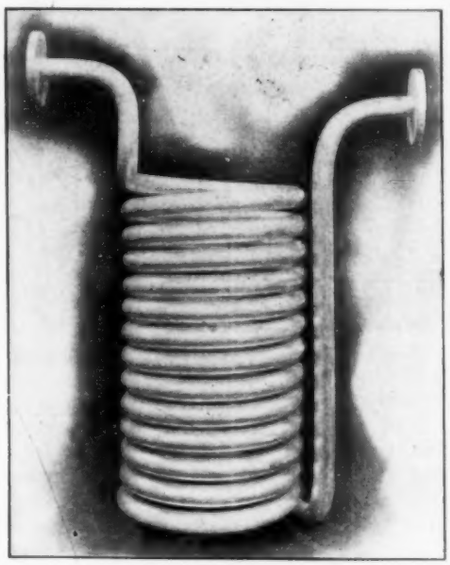
The production of spelter for the first six months of the year has been canvassed by C. E. Siebenthal, of the United States Geological Survey, with the following results expressed in short tons. The output of spelter was 207,634 tons made from domestic ores and 8,898 tons from foreign ores, a total of 216,532 tons, as compared with 177,991 tons for the preceding six months, and with 175,058 tons for the first six months of 1914. The apparent domestic consumption for the six months period was 160,906 tons, as against 149,762 tons in the preceding six months, and 149,306 tons in the first six months of 1914.

RECENT DEVELOPMENTS IN ALUMINUM *

(Some Notes on Autogenous Welding.)

By Ernest V. Pannell.

Aluminum is of all commercial metals the one whose surface is most easily oxidized. By this it is understood that the metal is subject not to destructive oxidation as is the case with iron, but that the surface when exposed to ordinary air is covered with an extremely thin impervious neutral film. This oxide covering, as in the case of other metals, is a serious obstacle to welding and soldering operations; its complete removal is necessary to secure a homogeneous metal-to-metal joint, and this removal can be effected only by chemical solution or mechanical abrasion. The chief difficulty lies in the fact that the presence of a flame of any kind tends to oxidize the metal as rapidly as it can be cleaned.



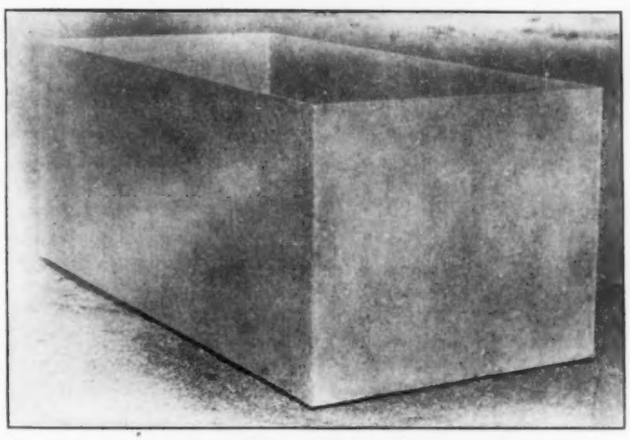
ALUMINUM TUBULAR CONDENSING COIL, CONTAINING ABOUT TEN WELDED JOINTS.

Owing to the fact that aluminum occupies a position high up on the electro-positive scale, its permanent union by means of other metals is therefore impracticable. Aluminum and tin or lead have a high contact voltage which in the presence of moisture brings about what is commonly known as galvanic action resulting in destruction of the joint. Autogenous welding is the applicable system of jointing. The finished weld must for stability's sake be pure aluminum right through and for this reason soldering does not give permanently satisfactory results; the aluminum reacts with the components of the solder giving rise to corrosion. A perfectly soldered joint requires high temperature, a suitable flux to dissolve the oxide and the use of a solder composed of nothing but aluminum; in other words, it becomes nothing but autogenous welding.

The oxy-acetylene torch, together with the use of a suitable flux have, however, solved most of the problems of aluminum welding. Previous to the introduction of this system the oxyhydrogen flame had been used, but this latter has the disadvantage of not giving sufficiently high temperature, except for small work on light gauge sheet. Pure aluminum melts at 650 degrees C., but to dissolve the oxide about 2,800 degrees of heat are necessary. In the hands of an unskilled welder oxyhydrogen would be safer and give better results, but they would bear no comparison with those obtained from the use of the acetylene flame when handled by a practised welder. In England and Germany large quantities of brewing vessels, confectionery plant, candy boilers, stills and condensing coils are now being manufactured of pure aluminum bent to shape and welded by the oxy-acetylene.

One of the essentials to successful welding is a flux of the requisite properties to remove the layer of oxide. The following are the compositions of several flux powders in use with aluminum:

		Per cent.
I.	Sodium Chloride	30
	Potassium Chloride	45
	Lithium Chloride	15
	Potassium Fluoride	7
	Sodium Bisulphate	3
II.	Lithium Chloride	33
	Potassium Chloride	33
	Sodium Fluoride	33



ALUMINUM DYE VAT.

III.	Lithium Chloride	20.8
	Potassium Chloride	62.5
	Sodium Chloride	12.5
	Potassium Bisulphate	4.0
IV.	Potassium Chloride	79
	Sodium Chloride	16
	Potassium Sulphate	5
V.	Potassium Chloride	83
	Sodium Chloride	17
VI.	Lithium Chloride	23.5
	Potassium Chloride	56.0
	Sodium Chloride	6.5
	Sodium Sulphate	4.0
	Cryolite (Aluminum-Sodium Fluoride)	10.0

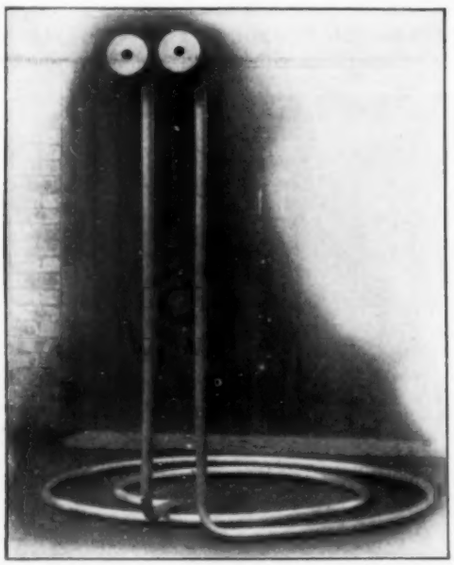
Most of these are patented in Europe in their country of origin. As will be seen, the composition is a mixture

* Abstracted from a paper presented at the Annual Meeting of the American Institute of Metals, September 28 to October 1, 1915, at Atlantic City, N. J.

of alkaline chlorides in various proportions. The melting point of the flux must be somewhat below that of the metal so that the former will melt and flux away the oxide just before the metal begins to flow. In actual use the flux powder is moistened down with alcohol. Otherwise it will be scattered by the draft from the blowpipe; in its dry form, too, the powder is very hygroscopic and liable to deteriorate due to absorption of moisture. Another method employs the flux in the form of a core to the feeding stick which is made hollow for the purpose. This can as a rule only be used as supplementary to the flux pasted on the joint. Feeding sticks are of pure aluminum or an alloy containing a small proportion of zinc and magnesium.

Some knowledge of the character and use of the blowpipe flame is important. In common with almost every gas flame that of the oxyacetylene torch has three zones.

The first zone immediately next to the blowpipe nozzle is a luminous jet where the oxygen and acetelyne are in process of combustion, burning with a white flame. The next is the reducing zone or envelope and this is the useful part of the flame where combustion is complete there is neither excess of oxygen to oxide the work or excess of carbon to deposit soot. The third is the oxidizing zone where owing to the proximity of the surrounding air

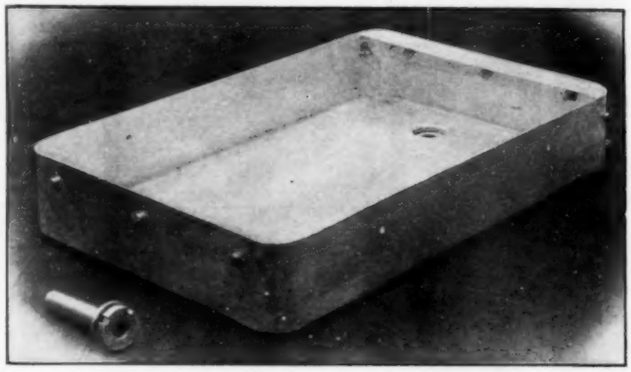


COOLING COIL. THE WELDS HAVE BEEN LEFT UNTRIMMED IN ORDER TO SHOW THEIR LOCATION.

there is excess of oxygen. If the acetylene is impure this outer zone will probably be luminous. For welding aluminum the work should always be in the reducing zone about ½" from the tip of the luminous jet. In adjusting the flame excess of acetylene will cause a luminous greenish envelope to form around the white jet. On throttling down the acetylene valve until this just disappears the flame will be found just right for welding, the gases being in their correct proportions.

Before commencing to weld, the edges of the joint are carefully squared, cleaned and fluxed. Practically all work except very light gauge sheet is butted, the thin sheets being lapped or hooked. The flame is usually applied at an angle of about 45° to prevent burning, but for thick sheets of 3-16" and upwards it may be directed perpendicularly upon the work. It has to be remembered that the flame gives temperature about four times the melting point of the metal so that once the oxide is fluxed away there is nothing to prevent holes being burnt in the aluminum except the dexterity of the worker. Speed is the prime requisite and the welder should be able to run down the joint with a torch and feeding stick at a uniform rate. In view of the high expansion coefficient of aluminum a certain clearance has to be left when commencing to weld which clearance will of course close up as the work proceeds. Further owing to the high thermal conductivity of the metal the heat is rapidly carried away from the seam, for this reason somewhat larger blowpipes are necessary with aluminum than for other work.

In many cases, particularly in the welding of large



ALUMINUM SINK WITH BOTTOM WELDED IN.

brewing vessels, it is desirable to have a man stationed at the back of the job to hammer up the joint whilst still hot as the welder proceeds. This slightly increases the strength of the joint and improves its structure.

At least one large European manufacturer adopts the method of hammering or rolling to remove the oxide, thus dispensing with the use of a flux. The joint is carefully cleaned, placed in position, heated up to about 450°C. (the oxyhydrogen flame gives sufficient heat) and then hammered or rolled. This process is useful for the manufacture of very large, thick, flat sheets, but it would be difficult to use for the manufacture of finished plant. Another field of work in which a flux is sometimes dispensed with is the repair of aluminum castings. Here the casting is heated up and puddled with the feeding stick. Experience, however, gives the conclusion that fluxing is the only sure means for dissolving out the oxide and facilitating a good weld.

The widest field for the products of aluminum welding is in the manufacture of large metal vats and utensils for brewing and industrial purposes* Compared with copper, aluminum sheets are 25% to 50% cheaper, 66% lighter and less readily attacked by organic acids. Any compounds formed with aluminum are absolutely non-poisonous and the metal is very easily cleaned. By welding and hammering the joints the walls of brewing vessels are made absolutely flush without any projections to harbor organic matter. Brewing vessels are constructed up to 25,000 gallons capacity, using aluminum plates up to 84" or more in width shaped upon bending rolls. The majority of these large vessels are cylindrical or spherical, but rectangular vats are widely used, many of these being of wood lined with sheet aluminum welded in the form of the tank. Welding is also necessary for the production of tubular distillation coils; as tubing (particularly in the larger sizes) can only be drawn in lim-

*The Metal Industry, May, 1914.

ited lengths, it is necessary to join up a large number of pieces to form a tubular coil of average dimensions.

A further important use which is made of the oxy-acetylene torch is for the welding of automobile bodies. Many of these, particularly the limousine type, are built up of aluminum sheet and the sheets are welded so as to secure an absolutely flush-sided body of streamline form. This, however, is only one of the many promising fields for the autogenous welding of aluminum.

RECLAMATION OF MAGNALIUM FROM TURNINGS*

Some Valuable Information Regarding This Magnesium-Aluminum Alloy.

By John Coulson.†

The use of magnalium metal for finished castings has increased to such an extent that the recovery of the metal from the turnings has become an important factor. This paper is a short account of an investigation of the problem, and outlines successful means of acquiring very reliable metal from the turnings, without suffering more than one or two per cent loss in the melting.

It is well known, of course, that magnalium metal is an alloy of aluminum and magnesium, having a specific gravity less than that of pure aluminum. Magnalium containing from 5 to 10 per cent of magnesium has very desirable physical characteristics, and castings made from it can be machined without difficulty. The extensive use of this metal, by the Westinghouse Company, in the manufacture of automobile parts, and electrical apparatus brought about the problem of recovering the metal from the great quantity of turnings resulting from the finished castings. Ordinary methods of melting down scrap metal could not be applied in the case of magnalium, on account of the rapidity with which the turnings oxidized. Therefore, a systematic study of the problem was taken up, and the results of this work, which was completed December, 1914, are perhaps of sufficient interest to warrant citation.

Oxidation of finely divided magnalium progresses more rapidly and violently than in the case of aluminum, and it is well known that freshly cut aluminum is covered with an oxide film immediately on exposure to the air. The temperature of a twisted mass of bare aluminum can be raised above the melting point without becoming diffused, the wire may sag, but when cooled will be found intact. The jacket of Al_2O_3 prevents the wire from melting into a solid molten mass, and becomes even stronger under comparatively high temperatures. Therefore, some process of agitating the melted material must be applied, in order to break up the oxide films, thus forcing the molten material to diffuse. Fluxes composed of chlorides and fluorides of the alkaline earths have been used with some success. Such fluxes when hot dissolve a certain amount of oxide, and their gassing throws about the globules of molten metal, inviting them to coalesce. The use of cryolite in the reduction of aluminum has long been known and is quite commonly used for smothering aluminum chips. The cryolite being first melted into a viscous state, then the scrap aluminum fed into the crucible and pushed under the surface of the flux, thus forming a protective layer of cryolite on top, which prevents the chips from further oxidation. The Foundry has used this method for sometime in melting magnalium turnings and the recovery for clean material varied from 60 to 90 per cent. Usually, equal weights of cryolite and turnings were added to the melting pot.

The use of cryolite as a flux is objectionable, however, since it attacks silicon or graphite crucibles vigorously, and iron pots cannot be used when pure metal is required. The desirability to avoid using it as a flux led to extensive experiments to find if it was possible to melt the turnings, without appreciable loss, in the presence of some inert or reducing gas. As the work progressed, small, special, air-tight, cylindrical shells were built according as the method of applying the gas demanded. The cavity inside the shell admitted a Gooch crucible which held the charges of turnings to be melted. Tight-fitting caps, pierced with gas pipes, closed the ends of the cylinder. The whole fitted inside an electric furnace, which had a limiting temperature of 1200° C. With everything in place, and after the gas had been washing out the system for five or ten minutes, the electric current was turned on and the temperature raised to 900°C. Of the numerous gases used throughout the work, hydrogen gave the best results. Tests were made to see if forcing the gas through the charge as in the Bessemer Process, would break up and diffuse the molten globules. but the results were inferior to those in the case where the gas was admitted through the pipe overhead. With the downward flow the loss was about 10 per cent. The loss always appeared in the form of fine white powder, and on examination of this residue it was found that nitrides were formed. A strong odor of ammonia was given off when the residue came in contact with water. The vigorous evolution of this gas indicated that nitrogen was occluded in some way, and most likely in the pores of the turnings, since great care had been taken to free the hydrogen used of all contamination.

The next step was to free the turnings of all foreign matter and occluded air, replacing it by some inoffensive fluxing agent, and common salt NaCl served this purpose very well, as will be seen. The turnings were boiled for a few minutes in a 4 per cent salt solution, this was poured off, taking with it the objectionable scum which would otherwise cohere to the turnings if they were scooped out. Further experiments were tried, using the apparatus described above, and charges of the turnings, still moist with the salt solution, but the results were not as good as we had expected. In every case a small amount of turnings remained intact and on top of the metal which had united. A new apparatus was constructed such that gas pressure from above forced the melted turnings through holes in the bottom of the crucible and into a receptacle underneath. In this way it was possible to recover about 92 per cent of the charge, but to use this method on a large scale appears difficult.

It was thought possible to melt the turnings in an open crucible after they had been boiled in a solution of slightly fluxing salt; experiment proved this method to be a success. The turnings, after being washed thoroughly in benzine, were boiled in a salt solution which was poured off just before feeding them into

*A paper presented at the Annual Meeting of the American Institute of Metals, September 28 to October 1, 1915, at Atlantic City, N. J.

†Research Engineering Department Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

the crucible. The crucible fitted snugly through a hole in the cover of an ordinary blast furnace and before starting operation it was heated to a temperature of 900°C. The damp turnings were then fed into the hot crucible and by mechanical means forced to coalesce as they melted. Each addition of turnings was thoroughly puddled until the mass again became uniformly viscous. Melts from 1 to 6 pounds were handled in this manner, using different salts and combinations of salts for the bath. A 4 per cent solution of NaCl gave very good results; the recovery being 96.2 per cent.

The application of this puddling process in melting the turnings in the open crucible without preliminary treatment in the salt solution also proved satisfactory. To start the melt a small pellet of magnalium was first reduced to a molten state in the bottom of the crucible, this permitted puddling to proceed on the first application of the turnings, thus smothering them immediately. The average loss from a number of melts, about 6 pounds each, was 6 per cent.

It is practically impossible to avoid the entanglement of some oxide in the melting. However, the physical characteristics of the reclaimed metal can be much improved, if not restored completely, by treatment or the introduction of a deoxidizing agent. Test pieces were poured from melts of new and reclaimed metal, which experienced different treatment, or had added to them a small quantity of deoxidizing metal. The results of the physical characteristics of a few of these pieces are tabulated below, and show what may be expected from the various combinations and treatment of the metal. As will be noticed, the magnalium made in the laboratory, and indicated by the first set of results, is much superior to the shop metal from which the turnings come. Therefore, the characteristics of the reclaimed metal from the turnings are not likely to excel those of the original magnalium.

From the foregoing discussion it is evident that a simple process has been developed for melting down magnalium turnings without heavy loss, or the aid of cryolite; and also possible means of improving the

MAGNALIUM PHYSICAL TESTS.

NEW MATERIAL.

	History of Pieces.	United Stress Lbs. Per Square Inch.	Yield Point Lbs. Per Square Inch.	Elastic Limit Lbs. Per Square Inch.	% Elong. in 2 in.	% Reduction.
Lab.	95% Al. 5% Mg	24500	11000	6000	9.2	13.4
"	"	23100	11000	5000	8.7	11.5
Shop	"	21700	19800	11200	1.8	1.6
"	"	24550	16250	11500	4.0	3.9
"	"	19630	17000	9700	2.3	1.6
Lab.	Al.	13150	7500	4000	33.0	52.0

RECLAIMED TURNINGS, FLUXED OR WASHED WITH HYDROGEN ON SECOND MELTING.

	History of Pieces.	United Stress Lbs. Per Square Inch.	Yield Point Lbs. Per Square Inch.	Elastic Limit Lbs. Per Square Inch.	% Elong. in 2 in.	% Reduction.
Lab.	No. flux	12100	11000	600	0	0
"	" "	13750	13750	10000	0	0
"	Hydrogen wash	13870	13800	7200	0	0
"	Under cryolite	20100	17500	10750	0	0
"	" "	11950	11950	9500	0	0
"	No flux, 45 minutes wait	19300	15250	800	1.5	3.5
Shop	Under cryolite	15000	13000	12500	0	0
"	" "	14500	12500	12500	0	0
"	" "	21750	21750	16500	0	0
"	" "	19500	19500	14500	0	0
"	" "	13750	13750	10000	0	0
"	" "	13900	13500	7200	0	0

It was found desirable to let the charge stand in the hot crucible for 10 or 15 minutes, after the last puddling operation. This gave the oxide time to rise to the surface, where it was held while the clean metal was poured from underneath. The dross-like mass that remained in the crucible, after pouring, contained some good metal, but this was separated from the oxide by adding a small quantity of $CaCl_2$ and stirring the whole vigorously. If the metal began to burn, as will be the case if the temperature gets much above 800°C, a little cryolite (powdered) stopped the action. Drawing the charge off through a hole in the bottom of the crucible, in place of pouring from the top, alleviated the danger of the charge burning up, and permitted the work to go on without having to displace the crucible.

The metal recovered from the turnings can hardly be expected to be as good as the original magnalium.

RECLAIMED TURNINGS DEOXIDIZED ON SECOND MELTING.

History of Pieces	United Stress Lbs. Per Sq.In.	Yield Point Lbs. Per Sq.In.	Elastic Limit Lbs. Per Sq.In.	% Elong. in 2 in.	% Reduction
Lab. ½% Al. Mn....	23000	20250	12500	1.3	3.9
" 1½% Met. Cal..	24750	16000	9500	2.0	3.9
" 1% Met. Cal....	24370	18000	8500	2.0	5.9
" ½% Cal. Al. Silicide.....	24430	19000	8500	3.7	7.8

quality of the metal thus obtained. In melting the turnings, most satisfactory results were obtained by first heating the crucible, or furnace to a temperature of 900°C, then melting down in it a pellet of solid

metal, preparatory to feeding in the loose turnings. This supplied molten metal to engulf the turnings at the outset, and permitted the puddling operation to go on at once. In the Foundry this method of procedure has been applied with success, the loss from a 200-pound charge being about 1 per cent. Here the recovered metal is poured in the form of large pellets, and later treated before making it into castings. From examination of the tables of physical tests it will be seen that the introduction of a deoxidizing agent brings the physical characteristics of the old metal up to that of the original shop material. The addition of 1 per cent of Metallic Calcium or one-half per cent of Calcium Aluminum Silicide is quite sufficient to restore the reclaimed metal to its original physical state.

THE DEVELOPMENT OF AN ACID-RESISTING ALLOY*

Some Experiments Made with the High Nickel-Copper Alloys.

By S. W. Parr.†

The increasing cost of platinum in recent years has emphasized the desirability of finding a substitute for that metal, especially in the construction of those forms of scientific apparatus having relatively large areas exposed to the corrosive action of acids and gases. Enamels have their uses and possibilities. Moreover, great advances have been made in the resistivity and other properties of that material.

The studies here referred to, however, have had to do with the production of a substance having, in addition to its chemical behavior, those physical properties which would render it suitable for use where density, strength and working properties are essential. For securing these physical properties we would naturally look to a metallic substance or compound. Where we add the chemical property of resistivity to corrosion we have very greatly complicated the problem unless we confine ourselves to the so-called noble metals. In its ultimate form, therefore, the question simply resolves itself into this: Is there a possibility of combining base metal to form a noble alloy? When we attempt to answer this question from the theoretical or scientific standpoint, we are at once impressed with the fact that there is very little available data or information that will be of assistance to us. We may theorize, perhaps, most naturally along this line: There are certain metals which are electro-positive towards certain other metals. Conversely, these other metals are electro-negative towards the first. Now may it not be that by a suitable adjustment of the two, a ratio may be found in which the electro-positive and electro-negative properties would neutralize each other and the electric potential be reduced to zero?

Possibly, some day, we may have such data and have it in terms of mass or molecule or otherwise, which will make it available for use in actual practice. But even so, the ever present impurities and their effect, often in minute percentages, the modifications attendant upon the formation of solid solutions and the multiplication of unknown factors following an increase in the number of complexes, combine to indicate that for some time at least we will be obliged to carry on our studies in this field very largely along the purely empirical line of trying many things. This latter method has been the one most followed in these studies though it is fair to say that the theoretical considerations above referred to have served a useful purpose in laying out the general procedure.

To discuss briefly the work pertaining to non-corrosive properties, it may be said that a degree of resistivity has been attained which was hardly thought possible at the outset. The unit of reference for measuring the amount of corrosion was adopted as follows: A standard disc of the alloy was prepared having 10 square centimeters of surface. This was submerged for a given length of time, usually twenty-four hours, in nitric acid of approximately 25 per cent. HNO_3. The loss in weight was calculated to the amount which would be represented for an area of 100 square centimeters per hour.

In test No. 23 a small casting of simple form was secured from which the test piece showed a loss in weight referred to this unit of surface and time of 0.03 mg. In test No. 40 a casting of more difficult form was secured weighing about ten pounds, the test piece from which gave an equally high degree of resistivity. In the last seven castings of similar size, Nos. 133 to 136 inclusive, six out of the seven standard discs did not show a weighable loss after contact with the nitric acid for twenty-four hours.

It will hardly be profitable to go into a detailed account of the difficulties encountered in reaching this end. The casting and working properties of the alloy had to be promoted in all of the modifications. At first thought this would seem to multiply the difficulties. On the contrary it proved to be more of an advantage than otherwise. That is to say, each additional element would tend to lower the melting point of the alloy and reduce the tendency to form an open texture or coarsely crystalline structure. If the resulting composition seems to be unnecessarily complex, the above statement may be a partial reason for that result. To the one who is seeking for a theoretical explanation, the suggestion is ventured that the electro-positive and the electro-negative elements are distributed in such a way as to tend at least to promote an electric potential of zero.

The chemical analysis of such an alloy is not simple and has been made the subject of special study referred to elsewhere. The analytical results as obtained on a representative sample are given herewith as the best means of indicating the general composition and type of the alloy.

TABLE 1.

COMPOSITION OF ALLOY NO. 117.
Analysis by S. A. Braley and F. E. Rowland.

Cu.	6.42
Mn.	0.98
Si.	1.04
W.	2.13
Ni.	60.65
Al.	1.09
Fe.	0.76
Cr.	21.07
Mo.	4.67
Total	98.81

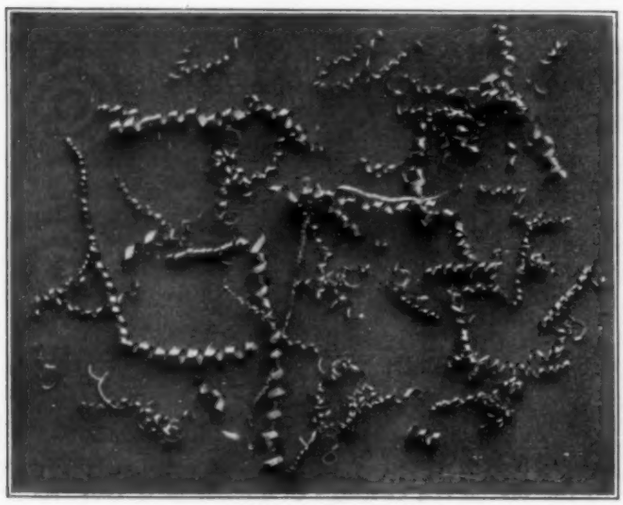
Carbon and Boron not determined.

The casting of the alloy proved to be quite as serious a problem as the development of the composition. The melting point is approximately 1,300 degrees C. The

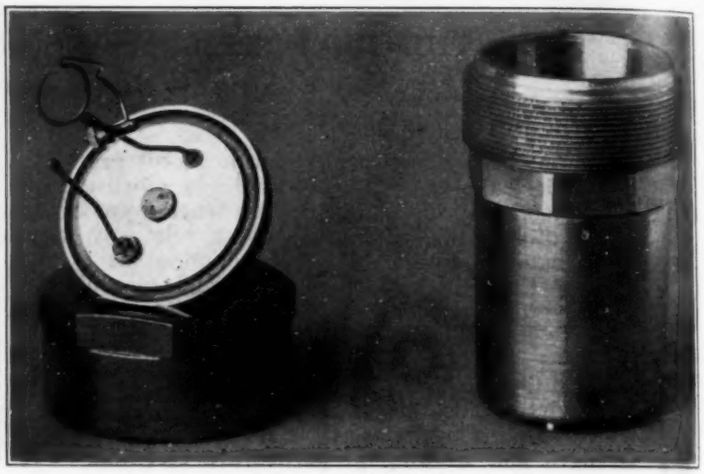
*A paper presented at the Annual Meeting of the American Institute of Metals, September 28 to October 1, 1915, at Atlantic City, N. J.

†University of Illinois, Urbana, Ill.

furnace must be capable of readily attaining the temperature of molten nickel, say 1,600 degrees. When thoroughly liquid the alloy pours readily and fills the mold perfectly but the freezing point is so quickly reached that feding of the casting from risers, to make up for shrinkage, is practically impossible. Moreover, the shrinkage is so excessive that cracks and hollow spots are very difficult to avoid. This feature can be perhaps better appreciated when it is noted that the most important instrument in mind for use of the alloy was a calorimeter bomb, which consists essentially of a chamber of approximately 35 cubic inches, which must retain absolutely without leakage, a gas at an average pressure of 25 to 30 atmospheres.



TURNINGS FROM "ILLIUM."



A BOMB CALORIMETER MADE FROM "ILLIUM."

Here again the very complexity of the composition has probably been the chief factor in securing a metal which could by any means be cast in the dense, homogeneous form required. The accompanying figures show the form of castings thus far undertaken. The lathe turnings show fairly well the character and working properties of the metal. It works about the same as tool steel. The interior surfaces of the bomb and cover show no trace of corrosion after use in over 1,500 determinations using the apparatus in determining the heating value of coals. In each determination there is generated a considerable quantity of nitric and sulphuric acids which condenses on the interior surfaces of the bomb. Under the prevailing conditions of heat and high oxygen pressure the best possible conditions exist for the promotion of corrosive action.

Attempts to draw the alloy into wire and roll it into sheets have been only partially successful, but sufficient to show the likelihood of success when the conditions for proper annealing are better understood. The tensile strength of the cast metal is approximately 50,000 pounds per square inch. The name suggested for the alloy is "Illium."

COPPER PLATING AS USED FOR PURPOSES OTHER THAN ORNAMENTAL*

AN ADDRESS DELIVERED IN DEFENSE OF CRITICISM DIRECTED AT THE AUTHOR'S PREVIOUS ARTICLE.

BY E. G. LOVERING.**

A great deal has been written about copper plating in general and as some ancient philosopher once quoted "there is nothing new under the sun." However, I will try and follow the lines of least resistance and try not to become too exuberant for fear the critic's criticism criticizes too critically and when the bombardment commences, I can retreat to a deeper trench and grab Brother Liscolm's flag of truce, called "the critic should be eliminated" and while the enemy is resting to bury the "dead," I will continue to rush on.

In relation to my article on The Brass and Copper Plating of the Future, which appeared in the April 1913 issue of THE METAL INDUSTRY, and which was so scientifically amputated and dissected by Professor Watts,† that it apparently had to be sent to the detention camp until the surgical department could get around to fit it with artificial limbs, before it could stand on its own merit; it is well to note that while Professor Watts was carrying on these operations and experiments in a laboratory on a small scale, the electro-platers have been using this method of copper plating in commercial and up-to-date plating departments on a large scale and meeting with excellent results. Such firms as the Sturgis Manufacturing Company, Sturgis, Mich., one of the first firms that the writer has knowledge of to adopt the copper cleaning and plating bath, are daily turning out thousands of pieces of their special line of goods and it is my sincere belief that there is nothing that would induce the above concern to adopt any other method of copper plating. The Buick Motor Company, the Lewis Spring and Axle Company, the Prest-O-Lite Company and others too numerous to mention are also using the cleaning and plating bath in combination, with excellent results. So regardless of Professor Watts' chemical bombardment, the patient seems to be convalescing and is becoming accustomed to the artificial limbs and will soon, no doubt, be abls to stand on its own "dignity."

However, the object of this article appertains to the electro-deposition of copper as used in the machine and automobile trade for purposes other than ornamental, which has increased the field for electro-plating. The automobile trade in general is installing copper plating plants for the electro-deposition of copper on automobile parts, such as cam shafts, gears, etc., previous to heat treating and hardening. The blank gears and forged cam shafts are sent to the copper plating depart-

*Paper read before Detroit, Mich., branch American Electro-Platers' Society November 5, 1915.

**Foreman Plater Lewis Spring and Axle Company, Detroit, Mich.

†Cleaning and Plating in the Same Solution. THE METAL INDUSTRY, June, 1915.

ment and given a heavy deposit of copper; they are then sent back to the machine department where the cam shafts are turned in the lathes or turning machines and the blank gears are cut in the gear cutting machines, leaving a deposit of copper on the parts which are to be left soft. They are then taken to the hardening room and hardened by the cyanide hardening process, which does not penetrate the parts that have a deposit of copper but leaves them soft and the exposed steel parts such as the cams and gear teeth being hardened.

Parts that require a driving fit are given a copper deposit of from .001 to .004 inch in thickness and then driven into place thus making a fit that cannot be vibrated or shaken loose. Wire wheels, spokes, nipples, rims, hubs, etc., are given a deposit of copper previous to painting and enameling. A local firm making wire wheels has equipment for turning out two hundred sets of wheels per day. The wheel is assembled, placed on a runway and its own momentum carries it to the copper plating room where it is hooked on to a conveyor running to the hot copper plating tank; the hot cleaning and copper bath being used. The wheel enters at one end of the tank and mechanically moves through the solution until it reaches the other end of the tank where it is elevated and run through a hot water bath and blown dry by the means of a pressure of air. From the plating room the wheels then roll on into the enameling department. Automobile radiators or coolers are also being made from sheet steel and given a coating of copper previous to painting and enameling operations.

Regarding the solutions used in this class of work, the majority of the platers are using a hot solution for their copper plating. A number are using the combination cleaning and plating bath as described in the April, 1913 issue of THE METAL INDUSTRY. Some platers are using soda ash instead of the lye or potash as mentioned in the formula, still other platers are using the hot cyanide copper solution made from either cyanide or copper carbonate, but the writer prefers the former method as the work does not need any preliminary cleaning, entering right into the plating bath as they come from the various departments such as the press room, machine shop or assembling room as the case may be.

Sheet steel tubing, drop forgings and parts that have fire scale that are not pickled in the ordinary pickling solutions are run through an electro-pickling bath composed of sodium nitrate and water, used as an ordinary electro-cleaning bath, with a reversed current. This solution gives excellent results for removing scale, etc., and the disagreeable fumes that arise from an acid pickle are eliminated. It also leaves the work clean and smooth and does not attack the steel like a sulphuric or muriatic acid pickle.

[1]This formula is

Hanson and Van Winkle XXX Lye (KOH)	½ pound
Copper Carbonate	2 ounces
Zinc Carbonate	2 ounces
Ammonium Carbonate	4 ounces
Potassium Cyanide	4 ounces

THE FAILURE OF STRUCTURAL BRASSES*

BEING A REPORT OF INVESTIGATIONS MADE AT BUREAU OF STANDARDS, WASHINGTON, D. C.

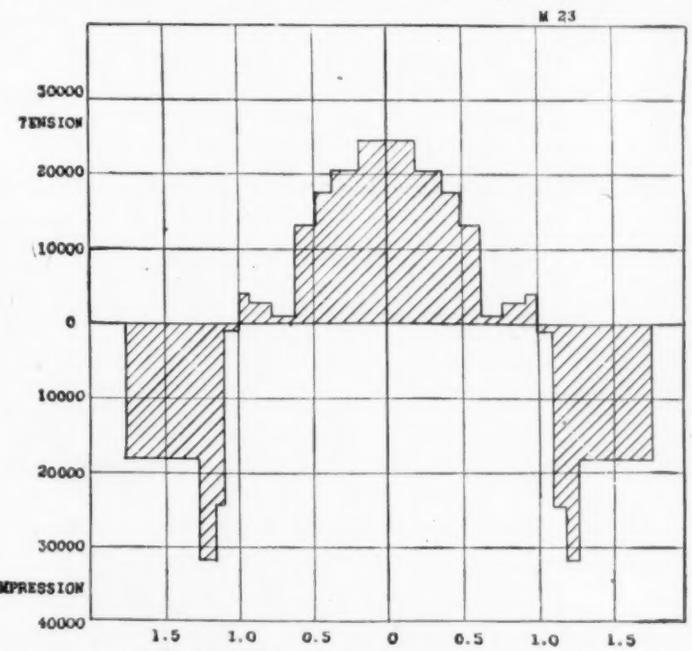
P. D. MERICA AND R. W. WOODWARD.

The season cracking of brass is a phenomenon well known to makers and users of brass alike and one need not search far in order to find interesting typical examples of such failure, such as the cracking of cartridge cases, of spun brass shapes, of condenser tubes, etc. Until the last few years, however, the fact that such material were not largely used for structural purposes has perhaps prevented giving to this subject the attention which it surely deserves of engineers and metallurgists.

A notable instance of the failure of large quantities of rolled and drawn brass (60:40 mixture) rods for structural purposes forms an interesting, though annoying, part of the experience of the New York Board of Water Supply in the construction of the new Catskill Aqueduct. Their experiences with the failure of brass were very interestingly described by Deputy Chief Engineer A. D. Flinn before the Municipal Engineers of the City of New York, 1914, and by Engineer Inspector E. Jonson before the American Institute of Metals, 1914, and form a valuable addition to our knowledge of the behavior of such materials in service. It was at the instance and with the co-operation of this board that an investigation was begun at the Bureau of Standards of these and similar brass failure. Since then other users of brass, notably the City of Minneapolis in connection with the construction of a new filter plant, have co-operated with the Bureau in this work.

In the present paper[1] an attempt will be made to present briefly the results which have been obtained so far in the work and to outline the course that the authors believe the general trend of work along this line should take, a program which is being followed at the Bureau so far and as completely as time and resources permit.

There seems to be little doubt that this problem in



its entirety is a large and comprehensive one[2], which must be attacked with the full co-operation of manufacturers and users of brass and of testing labora-

*A paper presented at the annual meeting of the American Institute of Metals, September 28 to October 1, 1915, at Atlantic City, N. J.

[1] A full account of this investigation will be published as a technologic paper of the Bureau of Standards.

[2] See the article by Ernst Jonson, THE METAL INDUSTRY, July, 1915.

TABLE I.

INTERNAL STRESSES IN BRASS SPECIMENS. MATERIAL WHICH HAS BEEN IN SERVICE.

B. S. No.	Lot	Manufacturer.	Failures.	Stress at surface.	Average stress lbs. per sq. in.	Maximum tension lbs. per sq. in.	Maximum compression lbs. per sq. in.	
3[a]				T	25,000	44,000	33,000	
22	A_1	A	Of this	C	18,400	28,400	28,200	
23	A_1	A	lot 83%	C	15,400	24,500	31,600	A_1 did not fail
28	A_1	A	failed	C	5,500	7,500	8,500	
32	A_2	A	in	C	17,900	20,500	26,500	
34	A_2	A	service	C	18,700	26,500	25,500	A_2 failed.
41	B	A	16% failed	C	4,450	32,000	5,500	Did not
43	B	A	in service	C	2,500	4,500	5,500	fail.
49	C_1	B	40%	C	3,100	3,500	9,000	Did not
54	C_1	B	failed	T	1,570	5,000	11,000	fail.
67	C_2	B	in	T	6,440	12,000	6,500	Failed.
68	C_2	B	service	C	3,910	7,500	7,000	
74	D	B	64%	C	15,700	17,000	21,500	Failed.
78	...	...		T	9,500	29,500	6,500	
116[b]	...	D	20%	C	9,900	7,500	15,000	
118[b]	...	D	failed in	T	8,500	3,500	19,500	Failed.
125 L[b]	...	D	service	C	4,300	2,500	5,500	
131 T	...	...	.....	T	1,790	5,500	2,500	
131 L	...	...	.....	C	17,800	19,500	59,000	
138[b]	...	D	20%	T	500	2,500	450	Failed.
140[b]	...	D	failed	T	18,000	46,000	42,000	Did not fail.
142[b]	...	D	.....	T	30,300	29,500	70,000	Failed.
156[a]	...	E	98%	T	5,350	27,000	20,000	Did not fail.
157[a]	...	E	failed	T	5,760	9,160	14,000	Did not fail.
158	...	E	.....	T	.....	30,000	.....	Failed.
160	...	F	More than	T	30,300	84,000	42,500	
161[a]	...	F	50%	T	.....	96,000	.....	
162	...	...	No failure	C	2,750	6,000	15,500	
163	...	...	.....	C	2,900	3,000	11,500	

NEW MATERIAL.

83	...	B	.....	T	1,000	2,500	1,500
85	...	B	.....	T	1,870	6,500	5,500
92	...	B	.....	T	750	1,250	1,000
94	...	B	.....	T	750	2,000	1,200
101	...	B	.....	T	1,870	8,000	2,000
103	...	B	.....	T	2,300	13,300	5,800

B. S. No.	Lot.	Manufacturer.	Failures.	Stress at surface.	Average stress lbs. per sq. in.	Maximum tension lbs. per sq. in.	Maximum compression lbs. per sq. in.
129	.....	G	.....	C	14,600	20,000	24,000
133	.....	H	.....	T	1,250	1,250	1,500
136	.....	B	.....	T	22,250	34,000	32,000
164	.....	J	.....	C	12,000	14,000	33,000
165	.....	J	.....	C	9,600	9,600	26,000
166	.....	J	.....	C	13,100	17,500	28,000
167	.....	D	.....	T	32,600	56,500	44,500
168	.....	D	.....	C	3,500	5,100	6,000
169	.....	D	.....	T	42,500	94,000	44,000
170	.....	D	.....	C	5,400	9,600	8,200
171	.....	D	.....	T	15,700	32,500	22,500
172	.....	D	.....	C	3,600	5,700	9,300
173	.....	D	.....	T	37,500	65,500	53,500
174	.....	D	.....	C	3,380	9,000	9,000
175	.....	K	.....	T	5,600	9,000	8,400

a The value of the modulus of elasticity was not yet checked out at the time of writing this article.
b These measurements were made on small specimens by dissolving off the metal, and are subject to large error, probably 50-100%.

tories. If this article has the effect of enlisting such aid and co-operation, its purpose will have been in great part achieved.

It is not necessary before this Institute to dwell at length upon the detailed description of season cracking and similar failures, as this has done before, both here[3] and elsewhere[4 5 6]. However, a few of the salient features of such failures may be noted. These are the following:

1. Such failures occur as far as now known only in brass which has been worked, i.e., forged, hot or cold rolled, drawn or extruded.

2. These failures are seemingly independent of composition.

3. The fissures or fractures occur, in general, transversely to the direction of the working.

It has been shown[7], and indeed is to be expected that such worked material is after finishing in a state of internal stress, the principal stresses being apparently in a direction parallel to the direction of rolling or drawing. It was, therefore, decided to make a survey of the initial stresses in a number of failed and other brass samples in order to determine what relation there was, if any, between the occurrence of these failures and the presence of initial stresses. These materials included those which had been in service, supplied both by the New York Board of Water Supply and the City of Minneapolis from its filter plant, and new brass samples supplied by brass manufacturers, including altogether some 175 samples. To all those who have co-operated by furnishing such material the authors' thanks are here expressed.

INITIAL STRESS MEASUREMENTS.

These measurements were made in the manner described by Heyn[8], of noting the changes in length of a bar caused by turning off successive layers in the lathe. The length measurements were made with an end comparator. Care was taken in machining the specimens to avoid the possibility of changes in length occurring as a result merely of the handling of the specimen on the lathe. A consideration of the sources of error of these measurements show the maximum error to be approximately 1000-2000 pounds per square inch, or 5 per cent.[9]

The results of these measurements are best plotted in the form shown in Fig. 1, in which a typical internal stress diagram is given, showing the magnitude and distribution of stresses in a piece of manganese bronze. The stresses (tension above and compression below the zero line), are plotted as a function of the diameter squared. From such a diagram the principal values, the maximum tension, the maximum compression and the average internal stress may be obtained. These values are tabulated in Table I for the specimens so tested.

It is seen from this table that with possibly one or two exceptions all the material which has failed has been in a state of considerable internal stress.[10] Indeed it is possible to trace a rough relation between the percentage failures of a lot of material and the average initial stress for that lot. This is shown in the table following.

Average stress for the lot in lbs. per sq. in.	Percentage of lot that failed
15,000	83
30,000	about 75%
15,700	64
7,000	20
3,500	16
3,000	4
2,000	0

In many cases there have been received from lots of material which had been in service both samples which had failed and those which had not. In these cases there was noticed in general that the average stresses in the failed specimens were greater than those in the others. The stresses are sometimes distributed so that tension is at the surface, compression inside, and often in the reverse manner. Apparently those with compression on the outside do not fail merely in storage, before being subjected to external stress as do those with tension on outside, but do so when installed in service.

(To be continued.)

[3] Loc. cit.
[4] Heyn, Jour. Inst. Metals, 1914. THE METAL INDUSTRY, February, 1914.
[5] Diegel, Verh. Ver. Bef. Gew., 1906.
[6] Howard, Trans. Am. Inst. Metals, 1913.
[7] Heyn, loc. cit.
[8] Journ. Inst. Metals, 1914.
[9] In case small internal stresses are obtained the maximum error is due to the length measurement, whereas in the case of high stresses the error is due chiefly to the error in the determination of the modulus of elasticity.
[10] The exception referred to is No. 138, and even in this case internal stresses of the value of 2,500 lbs. per sq. in. were found.

METALS FOR SHELLS.

Metals used in making shells to fill the war orders already placed are estimated by an English contemporary at over 10 per cent. of the 1914 copper production of the United States, about 7 per cent. of the spelter output and nearly 20 per cent. of the lead production. A British 18-pounder, or 3.3-inch shrapnel, requires 5 pounds 9⅛ ounces of brass containing 66 to 70 per cent. copper, or nearly 3¾ pounds. A small copper band around the shell adds 4¾ ounces, making the total copper 4.04 pounds. Spelter consumption for a shell of this size is about 1.87 pounds. Lead bullets weighing 7.92 pounds and composed of seven parts lead to one part antimony constitute the metal load of the projectile. Estimating the total orders for shrapnel and other shells placed in the United States by Europe at 25,000,000, they would call for a total of 101,000,000 pounds of copper, 46,750,000 pounds of spelter and 173,250,000 pounds of lead. Actually the metal consumption is larger, as a fair proportion of the shells are 4.7-inch howitzer shells using more brass. Some 6-inch, 7½-inch and probably 9-inch shells are also being made. Rifle cartridges are made of copper mainly, one pound of it being used in making twenty-four Lebel cartridges, a type widely used by the French army. Every 125 of these take one pound of spelter and a small amount of nickel. Steel consumption per shell varies widely in different types. A finished 3.3-inch shell contains 6 pounds 15¼ ounces of steel, the shell weighing 6 pounds 5¾ ounces and the diaphragm 9½ ounces. If the shell is made from a steel bar the weight is about 17 pounds, while a forging for the same purpose weighs approximately 14½ pounds and a bottle made by the seamless-tube process somewhat less.

ZINC ORES FROM BRITISH COLUMBIA.

The production of zinc ores has increased about 25 per cent. over that of last year so far, and could be still further increased but for the difficulty of finding a market. There are no spelter works in Canada, and American spelter works, being loaded up with stocks of American ores, do not wish to buy from British Columbia. The ores and concentrates produced here carry considerable lead, and so long as cleaner zinc ores are available they are naturally preferred.

MANGANESE-BRONZE*

A Description of its Manufacture From Various Scrap Materials.

By Lieutenant J. B. Rhodes, U.S. Navy.

At the Washington Navy Yard the accumulation of a large quantity of miscellaneous non-ferrous scrap has led to the careful study of the metallurgical problems connected with the successful use of such materials. It is proposed to deal in this paper with the production of manganese-bronze ingots alone, and to describe the materials used and the foundry practice, so that the experience gained here may be of value to others who are confronted with a similar problem.

The accumulation consisted chiefly of skimmings, turnings and trimmings, and obsolete or defective castings of compositions so doubtful that it was not considered advisable to use the materials directly in the production of castings. The yellow-metal scrap only is worth considering, although small amounts of red-metal scrap can be used to obtain the necessary tin. The following materials were available with composition approximately as shown:

1. Naval Brass: Copper 62 per cent., zinc 37 per cent., tin 1 per cent.
2. Cartridge-case Metal: Copper 68 per cent., zinc 31.6 per cent., nickel 0.4 per cent.
3. Manganese-bronze: Copper 59 per cent., zinc 41 per cent.
4. Commercial brass can be used in small quantities but should be avoided, as the lead content is too high.

Of these materials (1) naval brass, and (2) cartridge-case metal can be and have been used in the manufacture of cast naval brass, but the demand for cast naval brass has not been great enough to warrant holding scrap for use in that alloy alone, so it has been necessary to work out an economical and practical method for manufacturing manganese-bronze ingots.

The results of experiments during about six months have shown that it is practicable to make high-grade ingots in an oil-fired Rockwell furnace of about two tons' capacity. This has been accomplished in spite of the well-known prejudice against open-flame furnaces in the manufacture of non-ferrous alloys. Oxidation has been reduced to a very small amount by using wood scraps from pattern shop and salt. The bath is protected by the molten salt, and the wood insures a reducing rather than an oxidizing atmosphere in the furnace. The zinc losses are lower than is the case when no covering is used.

Before undertaking the manufacture of manganese-bronze itself a special hardener is made. This hardener is really the secret of the whole process, and although it can be made in any desired proportions, it has been found that the following is most satisfactory: 100 pounds copper, 25 pounds mild steel, 25 pounds (80 per cent.) ferro-manganese. The ferro-manganese and mild steel are melted and the copper (usually copper wire or other scrap) added as fast as the mixture will take it. Pots should be well stirred in the furnace. The alloy is best made using pots containing about 250 pounds each, and pouring these into a ladle for casting. Great care should be taken to skim the pots before pouring into the ladle. The hardener can be cast into ingots in green-sand open moulds. After carefully skimming, both in the pot and in the ladle, it will be found that practically all of the carbon has been eliminated, as it separates from the alloy, floats on the top and is removed by the skimming. The resultant alloy will be quite clean, and can be readily broken into pieces of any size. The alloy has a characteristic blue-gray color.

This hardener has proved most satisfactory as a means of introducing the desired percentages of iron and manganese. Aluminum and tin are added at the end of the heat, as needed, to make up the desired percentages of these constituents.

In determining the proper amount of scrap for a charge, the approximate analysis of scrap on hand must be known. It is necessary to consider the scrap as so many pounds of copper, tin and zinc, and sufficient accuracy will be found if we work out the mixture to contain 57 per cent. copper and add aluminum and tin as may be necessary. Suppose there is on hand a stock of scrap condenser tube containing, approximately, 70 per cent. copper, 29 per cent. zinc and 1 per cent. tin. In order to bring the copper content to 57 per cent. it will be necessary to use only about 78 pounds of scrap per 100 pounds of manganese-bronze. Zinc is added to reduce the percentage of copper.

The composition desired is as follows: Copper 57 per cent., zinc 40 per cent., iron 1 per cent., manganese 0.75 per cent., aluminum 0.75 per cent., tin 0.50 per cent.

To obtain manganese 0.75 per cent., about 5 pounds of hardener should be used for every 100 pounds; this gives 2½ pounds copper, so that only enough scrap (condenser tube) should be added to bring copper content to 57 per cent., *i. e.*, 54.5 pounds of copper, which will be obtained from 78 pounds of scrap. This amount of scrap will carry 0.78 per cent. tin. In addition to these, one pound of aluminum should be added for every 100 pounds of charge as computed. Aluminum, manganese and tin will be burned out to a slight extent.

We now have 78 pounds condenser tube, 5 pounds hardener, 1 pound aluminum. To this should be added 16 pounds zinc to bring total to 100 pounds. This gives a zinc content of 38 per cent., assuming that there are no losses. About 5 to 8 pounds more should be added to make up for losses, which actually do occur, and the desired composition will finally be obtained.

After analysis of the heat the amount of zinc necessary to bring zinc up to 41 per cent. can be calculated, and this amount should be added when re-melting for pouring into castings. The best bronze, showing the highest tensile strength, is a bronze containing 41 per cent. zinc. If zinc drops to even 38 per cent., tensile strength is reduced and elongation is increased and a soft bronze obtained.

In melting in the oil furnace the most difficult scrap to melt should be charged first, although all but finals may be charged at once. As soon as melted the hardener should be added. In about half an hour charge the remaining scrap (if charge is not made all at same time) and continue the melt. After the heat is well up add zinc, then tin (if necessary) and finally aluminum; stir well and tap. Small ladles are used for pouring the ingots. Ingots are numbered to show the heat and turned into the store awaiting analysis. The cost of the method is high, on account of the labor in pouring and marking ingots, but counting in furnace loss, labor, fuel and upkeep of furnace, it is less than two cents per pound, so that scrap worth 7½ cents per pound can be converted into manganese-bronze to cost not over 10 cents per pound.

One of our heats gave 82,000 pounds tensile strength and 28 per cent. elongation. Quite frequently 75,000 pounds tensile strength and 20 per cent. elongation are obtained in sand castings. If high pouring temperatures are avoided good metal may be had.

* Paper from the Journal of the American Society of Naval Engineers.

THE ELECTROLYTIC ASSAY OF LEAD

A Rapid Method for the Determination of Lead of Interest to the Brass Mill Chemist.

By Ernest A. Lewis, F. C. S.*

The accurate assay of lead in metals, ores and residues, is now an important test, and perhaps the following description of the estimation of lead in various substances, which is used in the author's laboratory, will be of interest. I may say that after numerous experiments and tests I have now abandoned the old method of weighing as $PbSO_4$, it is cumbersome, and, if accurately done, a very long process.

Any type of Rotating Electrode may be used; the shape is immaterial. The method of estimation varies with different substances, and the concentration of the acid is important, particularly in the case of small quantities of lead in cartridge metal and such like material.

BRASS.

To determine lead in cartridge metal and rolled brasses of various kinds, I dissolve 5 grammes of 40 c.c. HNO_3 (1-1) and boil off the nitrous fumes, dilute to about 150 c.c. with warm water, and electrolyze with a current of 3 amperes for 25 minutes, then wash in the beaker and covers, and continue for another five minutes. If the electrolyte is not required for the iron separation, the motor is stopped and the beaker removed, and replaced with one of distilled water, very quickly stopping the current at the same instant. The anode is then well washed with a stream of cold water from a wash bottle, then dipped into a beaker containing absolute alcohol, and finally into another beaker of absolute alcohol. The anode is placed on a watch glass and dried in the air oven at 200° C., for half-hour; if very little lead is present ten minutes drying is sufficient. The PbO_2 contains 86.6 per cent. lead. When over 20 per cent. lead is present, the factor taken should be 86.5 per cent. lead. If the iron is required, I put the solution of the brass in a 300 c.c. tall beaker, and after depositing the lead, lower the beaker by removing the wooden blocks upon which it stands, and wash quickly with a stream of water from a wash bottle; very little water is required. I then remove the electrolyte and estimate the iron in it in the usual way. Then put the electrodes in a beaker of water, as before, afterwards dipping in alcohol. The lead oxide does not dissolve if the operation of washing is done quickly; the PbO_2 deposited on a rotating anode appears to be less easily soluble than that deposited on a stationary anode. In the case of brass, containing very little lead, the solution for electrolysis must only be slightly warm, not above 40° C., or the lead will not come down, and in the case of cartridge metals containing 0.03 per cent, or less of lead, 10 grammes should be taken and dissolved in 80 c.c. HNO_3 (1:1), diluted to about 200 c.c. and electrolyzed.

GUN METALS.

In the case of gun metals I proceed exactly as in the case of brass, with the exception that I dissolve 5 grammes in 30 c.c. strong HNO_3, and 15 c.c. water, and after digesting to remove nitrous fumes, I dilute with hot water, allow the tin oxide to settle, and filter it off; the electrolysis of the filtrate is then proceeded with. It is a mistake to think that lead comes down with the tin oxide in ordinary gun metal to any serious extent; the tin oxide is only contaminated with antimony, phosphorous arsenic, iron, and a very little copper. It is quite unnecessary, and is likely to be inaccurate, to evaporate the solution of the gun metal containing tin oxide to dryness or pastiness, either on a water bath or a sand bath, as is often stated in descriptions of this process.

WHITE METALS.

With white metals containing very little tin, I estimate the lead exactly as in a gun metal, but with tin-lead solders and rich tin alloys, I digest the tin oxide precipitate after filtering it off, with ammonium sulphide solution; it dissolves out the tin and leaves the small quantity of lead as sulphide of lead. This is filtered off and digested with about 15 c.c. strong HNO_3, to oxidize the lead to sulphate; hot water is added, and the solution boiled, allowed to cool, and the small quantity of lead estimated by electrolysis separately, and added to the main bulk, which has in the meantime been electrolyzed.

SPELTER.

In the case of spelter, I weigh out either 5 or 10 grammes, according to the lead supposed to be present, and dissolve in 40 c.c. or 80 c. c. HNO_3 (1:1), adding the acid very cautiously, 1 or 2 c.c. at a time, or it will boil over; then boil off the acid fumes, dilute to 150 or 200 c.c. with hot water, filter off tin if present and electrolyze; in the case of a very high grade spelter the temperature must not exceed 40° C. It is remarkable that when a relatively large quantity of lead is present, in all cases it comes down even at 70° C. completely, but in small quantity the temperature has to be kept below 40° C., or it will not all come down. The electrolytic assay is by far the most accurate when properly carried out.

If an exceedingly accurate assay for lead in spelter is wanted, as happens sometimes in the case of disputes, I take 20 grammes, and treat with a mixture of 40 c.c. strong sulphuric acid and 200 c.c. water, cooled under the tap for several hours, until the bulk of the zinc is dissolved, then filter off the lead and dissolve it in 15 c.c. HNO_3, boil off the fumes and dilute to 150 c.c., filtering off tin if present; this is very rarely present in high grade spelters; add another 5 c.c. HNO_3, and electrolyze.

ORES AND RESIDUES.

In the case of ores and residues I grind them up to go through a 60 sieve, separating fires and metallics in the case of residue. Weigh out one gramme in the case of a sulphide ore or a sulphate residue, digest with 30 c.c. strong HNO_3, until all the sulphide is converted into sulphate, boil off the nitrous fumes, add about 100 c.c. hot water and heat until the $PbSO_4$ dissolves, then electrolyze, immediately with 3 amperes for half an hour, without filtering off any residue; if very little residue is present, the anode can be weighed after drying at 200° C. in the usual way, as with brasses; if much residue is present, the anode immediately after disconnecting, is put into a small beaker, with enough dilute HNO_3 (1:3) to cover it, and heat cautiously; when it is warm add two or three crystals of oxalic acid, the lead oxide dissolves, the anode is washed, and the solution of lead nitrate diluted, filtered if necessary, 10 c.c. HNO_3 added, diluted to about 150 c.c. and electrolyzed again. The lead oxide is then weighed.

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BRONZING PROCESSES SUITABLE FOR BRASS AND COPPER*

AN INTERESTING COLLECTION OF FORMULAE FOR THE ELECTRO-PLATER.

BY T. I. BAKER, SR.

The processes dealt with in this paper are confined to those which depend upon chemical or electro-chemical reactions for the production of color films.

Preliminary Cleaning.—At the outset it is emphasized that it is imperative that all work should present a clean metallic surface to the coloring solution. Accordingly the work, after polishing, is immersed in a scalding hot 5 per cent. solution of caustic potash in order to remove any grease. The cleansing process may be accelerated by brushing the work with a cotton or vegetable fibre brush wetted with the hot caustic solution. Any discoloration or tarnish produced upon the work may be removed by a momentary immersion in a 5 per cent. solution of potassium cyanide.

Brightening with "Ackey."—Some kinds of work, such as military ornaments and other similar stampings, are colored without having been polished. Such work is brightened by being dipped into an acid mixture called "Ackey" by the workmen who use it. The dipping mixture may contain:

Aquafortis (unrefined nitric acid) . .	1 volume.
Water	2 volumes.
Brown oil of vitriol (unrefined sulphuric acid)	3 volumes.

This mixture is put up in carboys, each of about ten gallons capacity, and is sold by weight.

After "dipping," the work may be further brightened by pressing it against a rapidly rotating wire brush lubricated with any suitable medium, such as an infusion of bran or a solution of half an ounce of glue in one gallon of water.

Methods of Deadening.—If the work is required to have a mat or dead finish, it must be deadened before coloring. Brass may be deadened by a brief immersion in a suitably prepared aquafortis dipping mixture called "Deadening," while brass or any other metal can be most effectively deadened by means of the sand blast. Another method of deadening is to imbed the work in sand contained in an earthenware vessel, and over which "Ackey" is poured in quantities sufficient to cover the sand. After a few minutes the work will be found to be beautifully deadened. The method of electrolytic deadening may also be used. The work is made the anode in a small vat charged with silver sand which is covered with diluted sulphuric acid, the cathode being formed of two strips of copper. The process, however, is tedious and not suitable for practical application in the works.

Parcel-coppering.—A piece of brass work is said to be parcel-coppered when a selected portion of the surface is coated with copper by electro-deposition. The operations are as follows:—(1) Stopping off; (2) Electro-coppering; (3) Removal of stop.

(1) Stopping off.—Copal varnish is tinted yellow or red by grinding into it a little lead chromate. The tinted varnish is then penciled over a selected portion of the work.

(2) Electro-coppering.—When the varnish is dry the work is lightly brushed all over with soda lime to remove any trace of grease. It is then passed through cyanide dip to remove traces of oxidation or tarnish, and after well rinsing, it is made the cathode in an acid electro-coppering bath in which a current density of about ten amperes per square foot of cathode surface is maintained during, say, half an hour.

(3) Removal of stop.—No copper is deposited on the varnished portion, and the varnish is quickly removed by brushing with mineral naphtha. The naphtha together with grease derived from the varnish is removed by immersion in a boiling hot solution of caustic potash. Tarnish is removed by cyanide dip, and the process may be completed by scratch brushing only, or by scratch brushing and polishing.

This method may be applied to parceling in other metals.

Steel Bronzing.—For this process the following arsenical solution is used:

Arsenious oxide . . .	20 ounces.
Copper sulphate . . .	10 "
Ammonium chloride . .	2 "
Hydrochloric acid (common) .	1 gallon.

For the ordinary steel color upon brass or copper the work is immersed momentarily in the cold solution, then rinsed and, if deemed necessary, scratch brushed. If a dark steel color is desired, the work should be immersed in boiling water and then, while hot, dipped in the cold arsenical solution.

Brass coats itself with arsenic more rapidly than does copper. If, therefore, parcel-coppered brass is immersed in the solution the brass immediately becomes coated with an opaque film of arsenic. On the other hand, the film upon the copper is so thin as to be translucent, and therefore the underlying copper considerably modifies the color of the arsenical film. Hence two different colors may be produced upon the same piece of parceled work by a simple immersion in this so-called steel-bronzing solution.

The necessity for the presence of the copper sulphate is shown by the following experiments:

(a) In a solution containing only hydrochloric acid and arsenious oxide, in the proportions already given, a brass tray became poorly coated in 6 1/3 hours.

(b) In another solution containing hydrochroic acid, arsenious oxide, and ammonium chloride, also in the given proportions, a similar tray was immersed for a nearly equal length of time and received an excellent coating of arsenic.

(c) A third solution containing hydrochloric acid, arsenious oxide, and copper sulphate, in similar proportions to those given, yielded a good coat of arsenic upon a brass tray immediately after immersion.

Black upon Brass and Copper (CuO).—The work, whether brass or copper, is dipped in the cold solution consisting of

Copper nitrate . . .	1 ounce
Water	3 fluid ounces

and then heated over a copper plate. The water evaporates, leaving a green basic residue. As the temperature rises ruddy fumes are evolved, and the previously green salt becomes black. It may be necessary to repeat the process in order to obtain a good jet black color.

An egg-shell lustre is imparted to the dull black surface by pressing the work against a rapidly rotating bristle brush lightly charged with beeswax. Substances other than metals may be colored black by this method, provided that they will withstand being raised to the required temperature without suffering injury. As an ex-

*Paper read before a recent meeting of Birmingham, England, Section of Institute of Metals.

ample, the author exhibited a terra-cotta modeled placque which he had colored by this method.

Black suitable only for Brass.—The solution used is of the following composition:

Copper carbonate . .	1 ounce.
Ammonium hydrate .	Slight excess.
Water	20 fluid ounces.

The work is immersed in the cold solution and allowed to remain until quite black. This solution slightly tarnishes copper, but has no action whatever upon gold, silver, or nickel. Hence if brass is parceled in gold, silver, nickel, or copper, the brass may be colored black by simple immersion, while the nobler metals will not be affected.

Electro-deposition of "Black Nickel."—A jet black color can be obtained upon certain metals by the electrolysis of a solution containing:

Nickel ammonium sulphate .	8 ounces.
Potassium sulphocyanide . .	2 "
Zinc sulphate	1 ounce.
Water	1 gallon.

Nickel anodes are used, and the work, which may or may not be nickel-plated before coloring, is made the cathode. A current density of about 0.2 ampere per square decimetre of cathode surface is used. The potential difference required to be maintained between the electrodes will vary with their distance apart, and will probably range between 0.75 and 1.5 volt. Immediately after starting electrolysis beautiful iridescent colors succeed each other upon the surface of the work, until at length the film of "nickel sulphide," at first translucent, becomes opaque, and finally jet black in color.

With regard to the importance of the presence of zinc sulphate in the solution, it was found that, when the zinc salt was omitted, no black deposit could be obtained, however much the strength of the current was varied; but on immersing a strip of zinc in the solution and in contact with the anodes, iridescent colors at once appeared and were followed by a jet black deposit of nickel sulphide, just as though the electrolyte had been of normal composition.

By weighing the cathode before and after deposition it was found that the black coating weighed 35.5 milligrams per square decimetre of nickel-plated surface, corresponding approximately to 5.1 grains per square foot. The black deposit is called nickel sulphide, but analysis shows that besides nickel and sulphur, cyanogen and ammonia are also present.

Blue upon Copper—Bancroft's Blue.—This was discovered accidentally by Bancroft and Briggs* while experimenting on the electrolysis of solutions of copper acteate containing gelatine. A sheet of metal which they had coppered in their gelatinous solution was inadvertently left immersed overnight in a solution of copper acetate which contained no gelatine. On removal from the solution the sheet was found to have acquired a beautiful blue color.

In carrying out this process two solutions are used, and are known as the electrolyte and developer respectively. The electrolyte may contain from 1 to 2 per cent. of copper acetate and 0.25 to 0.66 per cent. of gelatine. The current density may vary between 0.15 and 0.45 ampere per square decimetre, and the time of electrolysis between five and fifteen minutes. The developing solution should contain 5 per cent. of copper acetate but no gelatine. After deposition the work is immersed in the developing solution, and allowed to remain until the blue color appears. In the cold solution the development may occupy several hours, but if the solution is heated to a temperature between 60° and 80° C. the color may appear after a few minutes' immersion.

Bancroft believes that the blue color is produced by the absorption of hydrous copper oxide which, as a product of hydrolytic dissociation, is present in suspension in appreciable quantity in the developing solution. In a repetition of Bancroft's experiment, in which a current density of 0.2 ampere was maintained during 15 minutes, the weight of the deposit was 58 milligrams. After having obtained the blue color by means of the developing solution, the tray was reweighed, and it was found that the coloring process had resulted in a loss of 1 milligram.

Coloring Reactions of a Solution of Copper Nitrate.—A 20 to 25 per cent. solution is used hot to color electrolytic copper, ordinary sheet copper, and brass. Electrolytic copper assumes a terra-cotta color, varying in depth of tone with the temperature and concentration of the solution, and with the time of immersion. Ordinary sheet copper assumes a darker color than that produced upon the purer electrolytic copper. The color produced upon brass in the same solution and under similar conditions is quite different from that produced upon copper. The color is a difficult one to define, and may vary in different batches of the alloy, from a dark neutral green to a color of a peculiar bronze tint. Slight variations in the composition of the brass may make it impossible exactly to match the color obtained upon work in the first batch.

Since the colors produced by this method upon copper and brass, respectively, are so very different, it is obvious that brass work "parceled" in copper can be parcel-bronzed in copper-nitrate solution.

The author believes that of all the color films with which he is acquainted, the two just described are the most permanent, and when in juxtaposition, as in "parceling," are most pleasing.

Florentine.—Florentine processes depend for their color upon the formation of copper sulphide upon the surface of the work. Hence brass work must be coated with copper preparatory to the coloring process. The solution used for the coloring is a 2 per cent. solution of yellow ammonium sulphide, and details were given to obtain the following varieties of Florentine: (a) Self Color, (b) Florentine, with relief, (c) Florentine, shaded and with black background. It must be noted that all work colored with sulphides needs to be lacquered.

Colors of Thin Films (Lead Sulphide).—These are best produced upon polished metallic surfaces, and need to be lacquered. The following are the instructions for the preparation and use of the coloring solutions:

(a)	Lead acetate . .	50 grains.
	Water . . .	5 fluid ounces.
(b)	Sodium thiosulphate	50 grains.
	Water . . .	5 fluid ounces.

Mix the hot solutions together, and allow the precipitate to subside. Decant the clear solution, and use it while hot as the coloring reagent. When highly polished and thoroughly clean brass work is immersed in the hot solution, colors succeed each other in the following order:—Gold, deeper gold, crimson, purple, blue, lavender, and, finally, lustrous steel.

When the final stage is reached, the film of lead sulphide has become so thick as to be opaque, and no light can be transmitted to or from its posterior surface, and the colors, due to the interference of light, no longer appear.

The coloring process can be arrested at any moment, so that many shades of color are obtainable.

(To be continued.)

*Transactions of the American Electro-Chemical Society, September 11, 1912.

EDITORIAL

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Vol. 21. No. 11.

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NEW SERIES
Vol. 13. No. 11.

THE METAL INDUSTRY

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CONTENTS

THE MONEL METAL YACHT

THE METAL INDUSTRY for August, 1915, contained an account of the yacht *Sea Call* built at the yards of Geo. Lawley and Sons of Neponsett, Mass., for Alexander S. Cochrane of Yonkers, N. Y. This yacht was built with monel metal plates on the hull below the water line. The idea of the owner and builders in employing monel metal in the construction of the boat was that the well-known resistance of the metal to corrosion would protect against the fouling of the hull by marine growths. Monel metal, as has been described in THE METAL INDUSTRY for January, 1914, is an alloy of about 68% nickel and 32% copper and was invented by Ambrose Monell, president of the International Nickel Company.

Three months after the vessel had been launched she was taken from the water and broken up for scrap. The steel parts of the boat that were in contact with the monel metal had been so badly corroded by galvanic action that they were practically destroyed. The whole story is so well told in an article published by Engineering News in a recent issue that we deem it only fair to the good name of monel metal to reproduce it here:

"According to the statement of the builders, it was the original intention of the vessel's designer, William Gardner, to use monel metal for the stem of the vessel, the rudder frame and the propeller frame, as well as for the under-water plating. Some difficulty was found in producing these parts in monel metal with the necessary accuracy and freedom from warping, and it was finally determined to use steel for these pieces instead.

"The framing of the hull was of steel bulb angles. Monel-metal rivets were intended to be used in all monel-metal plates. In a very few cases, however, steel rivets were used by mistake in the monel-metal under-water plating. Attention was first attracted to the serious corrosion that was going on by the failure or total disappearance of one of these steel rivets. A stream of water entering through the open rivet hole was temporarily stopped by a pine plug and later by sending down a diver who put in a steel bolt as a permanent repair. In a very few weeks, however, this bolt was also eaten away. About this time it was decided to haul the yacht out of the water to remove the marine growths that had accumulated on the hull, for it was found, contrary to the expectation of the designers, that the salt water had so little effect on the monel-metal plates that the hull rapidly accumulated enough "grass" to check the vessel's progress. The serious corrosion which had taken place on the steel parts under water was discovered when the hull was exposed to view.

"The most severe corrosion took place on the thin steel rib which forms the outer frame of the rudder (the rudder itself being covered with monel-metal plates). The reason why the corrosion was so severe here was very likely because of the rapid flow of water across the rudder edge, removing the corrosion as fast as it took place and thus presenting clean metal to the action

of the electric current. A similar effect, almost as severe, took place on the steel stem of the vessel. Deep pits were eaten into the steel. There was heavy corrosion also on the steel propeller-frame casting and rudder shank.

"The monel metal itself, as would be expected, showed not the slightest evidence of corrosion anywhere; and had the corrosion been confined to these outer steel pieces described, they could probably have been replaced at no serious expense by similar parts of monel metal and the galvanic action thus terminated. A more serious situation, however, was presented by the interior of the vessel. It was clearly evident, from the action on these exterior steel parts, that as the interior steel framing was connected to the monel-metal plates, corrosion would be inevitable there under the action of the bilge water. The probability that this might proceed unnoticed until the vessel's structure would be seriously weakened was doubtless the consideration that led to the decision to cut up for scrap a vessel which had been launched no longer ago than last March.

"The possibility of galvanic corrosion occurring had evidently suggested itself to the designers of the vessel, for we are informed that experiments extending over several months were made at the Lawley yards on plates of monel metal and steel electrically connected and immersed in sea water. These experiments, we are informed, showed no appreciable corrosion of the steel and no measurable current in the wire connecting the plates, and it was therefore deemed safe to proceed with the construction of the *Sea Call* on the lines described. The present condition of the vessel, however, is indisputable evidence that the conditions in the boat itself were entirely different from those which existed in making the experiments referred to. It is doubtless true that the area of monel metal exposed to the sea water being very large in comparison with the area of steel exposed, the corrosion of the steel was concentrated.

"It seems indeed strange that some such action should not have been foreseen in view of the large amount of evidence on record as to the effect of galvanic action between steel and some of the copper alloys when immersed in sea water. Monel metal, we are informed, is almost identical with manganese bronze in its electrical relation to steel when connected as a galvanic couple. In ships which use manganese-bronze propellers it has become common practice to attach plates of zinc to the hull. As the zinc is more electro-positive than the steel, the corrosion due to the galvanic action with the manganese-bronze propeller is concentrated upon the zinc and the steel is protected."

From the foregoing it will be seen that monel metal was not really to blame for the collapse of the vessel as the plates themselves showed no corrosion. The responsibility must be placed on the manner of construction. The case of the *Sea Call* is but another strong argument in favor of the importance of coordinating laboratory experiment to actual practice.

WAR METAL BUSINESS

The unprecedented demand brought about by the European war for metals necessary for the manufacture of war materials has developed an unusual condition of prosperity in the metal business. Every concern engaged in the manufacture of brass and other alloys has found its normal capacity far too small to take care of offered business. This has resulted in feverish activity in building operations. Not only have existing plants rushed extensions and additions to competion but new concerns have been organized and others already established in lines foreign to the brass business have gone, or are making haste to go into it. Thus a western concern now rolling copper is preparing to make brass while another plant making milk cans is now making cartridge shells. Still another, manufacturing steel tubes for umbrellas, is making or attempting to make small cartridge shells.

One of the striking results of this activity in the metal business is to be seen in the columns of the daily papers. We refer to the operations of the stock market. It is rather unusual to find the stocks of the various metal manufacturing concerns figuring in the advertisements of the financial houses dealing in stocks. In the current issues of the daily papers we find that shares of such concerns as the Scovill Manufacturing Company, American Brass Company, Yale and Towne Manufacturing Company, Winchester Repeating Arms Company, New Jersey Zinc Company, etc., are not only wanted for purchase but also are offered for sale. These advertisements tell their own story of fortunes made and lost.

The perusal of the Trade News columns of this issue of THE METAL INDUSTRY will give a good idea of how extensive this activity in the metal business is. There is, however, considerable speculation as to just what will happen should the war come to a close within a short time. It is asked, would not there be a considerable loss due to the cancellation of existing contracts? We do not believe that such would be the case as far as concerns the manufacturers of brass, for we understand that contracts are being taken in such a manner as to insure against easy cancellation. It is becoming more difficult every day to place such contracts as the mills demand a goodly portion of the cash value of a contract to be placed in escrow so that the buyer takes all risks due to sudden cessation of hostilities. We understand furthermore that business is even now being taken for the next two years, so the end is not yet. What will be the future of the brass business after the war with the greatly enlarged capacity for production no one can tell, but it is safe to say that times will be good in the metal trades for some time to come.

ARSENICAL COPPER

In view of the very important place copper now occupies in the metal industry of today, some information recently given out by Mr. Ernest Lewis, a Birmingham, England, metallurgist, may be of interest:

"When speakers talk of arsenical tough copper and compare its properties with deoxidized arsenical copper, nickel copper or deoxidized phosphorical copper they might as well compare the properties of Bessemer rail steel with wrought iron. Practical men cannot understand these discussions. The object of my article is to clear up some of the popular errors in the copper trade.

"In the first place arsenical tough copper such as is cast from the refinery process into billets to make into tubes or cakes for rolling into sheets or even bolts for rolling into rods, can be made by two distinct methods, and the two distinct metals have decided differences in their properties. One can add the arsenic either in the form of metallic arsenic or as white arsenic. To my knowledge some works use the one method and others the other. So long as the copper obtained will pass the various specifications, it is immaterial how it is made. It is useless for investigators to make a few investigations on one particular kind of copper and then draw up deductions from this and say it represents all kinds of copper. It will not. Some two or three years ago the copper trade was assured that bismuth and arsenic strengthened copper and that silver was present to the tune of .08 per cent. occasionally. The copper smelters of the world are not philanthropists, and I venture to say that if by an accident a parcel of copper containing .08 per cent. silver did get to this country it is not a regular thing. The same author in his reply to a destructive criticism of his paper said it was childish to talk of copper being cast from crucibles. Anyone would think from his remarks that copper tubes are not cast from crucibles at all; I can assure him that they are and their quality is excellent, and, furthermore, that his critic knew what he was talking about.

"Having disposed of the two kinds of arsenical copper cast from the refinery furnace, frequently in 20 ton charges, I pass on to that cast from crucibles. The arsenical copper cast from pots can only be made from good brands of electrolytic copper, and the arsenic can only be added to this class of copper in the metallic form and further than this it is essential to add also some phosphorus to remove nearly all of the oxygen. The result is a very tough copper, provided it is rolled at the right heat, if it is burnt at all it is deteriorated, and here I will point out for the benefit of my friends who write on copper that the arsenical copper made in the refinery furnace using white arsenic as the means of adding the arsenic will stand a higher temperature in annealing than the same kind of copper made with metallic arsenic, and that the arsenical copper cast from crucibles will not stand as much heat as that made in a refinery using metallic arsenic. This is where practical experience comes in, and it is supposed to be one of the great secrets of the copper trade."

CORRESPONDENCE AND DISCUSSION

WE CORDIALLY INVITE READERS' OPINIONS AND CRITICISMS OF ARTICLES PUBLISHED IN THE METAL INDUSTRY.

NEW BOOKS

WATERBURY BOOK OF ALLOYS. By R. A. Wood. Size 8 by 9¼ inches. Loose leaf construction. 229 pages. Sold only on subscription for $5.00. For sale by THE METAL INDUSTRY.

This work is probably the most notable contribution that has been made to the literature of the manufacture of brass. The author is an experienced and practical brass man of many years' standing and the matter contained in this book has been gleaned from his everyday practice carried on for more than twenty years.

Mr. Wood's idea in publishing this book is to furnish a starting point for those who wish to become acquainted with the manufacture of brass alloys and he proposes to furnish to subscribers from time to time additional matter in the form of loose sheets which may be added to the original work. He also places himself at the disposal of his subscribers in the matter of answering questions or solving problems which may come up in everyday work and whose solution is not to be found between the covers of the original volume. We believe that this "Waterbury Book of Alloys" will meet with a cordial reception from the brass trade.

HENDRICKS' COMMERCIAL REGISTER FOR BUYERS AND SELLERS. 1915. Size 8½ by 10½ inches. 1,500 pages. Bound in leather instead of cloth as formerly. Published by S. E. Hendricks Company, Inc. Price $10.00. For sale by THE METAL INDUSTRY.

This is the twenty-fourth annual edition of Hendricks' Commercial Register of the United States for Buyers and Sellers, and is especially devoted to architectural, contracting, electrical, engineering, hardware and kindred industries.

GALVANIZING AND TINNING. By W. T. Flanders. Revised and enlarged edition. We are assured by the publishers of this long looked for work that it will be issued and available for distribution by November 15. Copies may be obtained from THE METAL INDUSTRY.

EVOLUTION OF THE PLATERS' ART

To the Editor of The Metal Industry:

I note in a trade journal that is supposed to guide others, some answers which I cannot exactly comprehend. I am wondering whether the answers are really intended to be taken seriously or are really jokes.

Here are the questions and answers. See for yourself and then have a good laugh:

THREE SIMPLE QUESTIONS.

(1) How much soda do platers put in a brass or copper solution, and why?

Answer.—"Soda serves for the preparation of metallic carbonates and for freeing objects from grease." Can you beat that for a joke.

(2) How is a black nickel solution made,

Answer.—Black nickel formula: Water, 1 gal.; double nickel sul., 8 ozs.; ammonium sulpho-cyanate, 2 ozs.; zinc sulphate, 1 oz.

Gentlemen! Gentlemen! Please preserve more decorum!

(3) What is the right way to take care of a nickel solution?

Answer.—To care for a nickel solution it is best to make a new one when the old gives poor results.

Can Bud Fisher beat that for a joke with his pictures of Mutt and Jeff?

These are only samples. "A Successful Brown Finish on Brass"—after two long columns of symbols—ends up by saying "Paint it Brown!"

"Cleaning Metals" causes a salvo of applause and laughs in every line. Therefore, the writer asks each and every subscriber to write you personally asking that you add a joy sheet to your journal and thus dispel the gloom that sometimes produces wrinkles and make laughter and gladness drive dull care away. "Mr. Plater, come out of your hole," as Mr. Procter said years ago.

Benjamin W. Gilchrist.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE OF THE METAL INDUSTRY. ADDRESS THE METAL INDUSTRY.

ANNEALING

Q.—Can you tell me at what temperature copper should be annealed for sheet rolling cold, for wire drawing cold, for tube drawing cold and for extruding cold or for making French bullets. The latter is the most important. I have my own figures from 500 degrees Fahrenheit to 800 degrees Centigrade. The latter figure is much too high, I should think, yet for the first compression the metal must be soft enough to flow and fill the die.

A.—The temperature for the annealing of copper is about 1,075 degrees Fahrenheit. It is difficult to secure uniform temperatures in an annealing furnace or to judge its exact temperature without the aid of a pyrometer. Hence where very soft copper is required a Brinell hardness testing machine should be available and the copper tested for thoroughness of annealing. If the hardness number is about 40, the annealing is satisfactory, but if it is 60 to 70 the copper is only partly annealed.—J. L. J. Problem 2,209.

BRASSING

Q.—Several unsatisfactory experiences with brass plated iron hardware causes me to question the utility of brass plating and I would ask you if there is any brass plated iron on the market which will stand ordinary wear for a couple of years without rusting, either indoors or out of doors in a sheltered place such as on a broad piazza?

If such plating is not done commercially, is it because platers do not take the time and trouble to produce a durable coating, or is it because a deposit of brass sufficiently thick to be durable cannot be produced?

A.—The deposit of brass upon iron hardware is controlled by the price the consumer wishes to pay for the article plated and not because the plater does not take the time and trouble.

While brass deposits cannot be built up as heavy as copper deposits a sufficiently heavy deposit can be had which will give satisfactory wearing results. If, however, such a deposit is required the cost will so closely approximate that of wrought brass that it would be better to purchase the solid metal.

An electro-deposit of zinc on steel or iron is the only one that will withstand atmospheric conditions for any length of time and a demand is now being made for hardware that has received an electro-deposit of zinc before being plated with any other metal for ornamental purposes, such as nickel, copper, brass or bronze. This double coating gives good service and is the only real satisfactory one for hardware which is exposed to the weather.—H. B. G. Problem 2,210.

CASTING

Q.—We are having considerable trouble with our bell metal for casting. Could you suggest a mixture which might eradicate our troubles and produce good results?

A.—The following mixtures may be of interest:

Church bells....Copper, 1 pound; tin, 4½ ounces.
Pit bells.....Copper, 1 pound; tin, 1 ounce.
Bell brass.....Copper, 14 pounds; tin, 1½ ounces; lead, 1½ pounds, and spelter, 2½ pounds.

If a definite statement is given of the mixture you now use and the exact troubles you are having it may be possible to suggest a remedy.—J. L. J. Problem 2,211.

COLORING

Q.—Can you give me a receipt for a nickel rouge that will scrub off the work easily and yet give a good lustre to the work as our articles all have designing on them and catch the dirt from the buff a great deal.

A.—We would suggest that you use a Vienna lime composition in coloring your nickel deposits instead of rouge compositions as it would be much easier to remove it from the depressions. It would also be much cheaper to purchase such compositions than try to manufacture them.—C. H. P. Problem 2,212.

CORRODING

Q.—A firm making a tanning extract from chestnut wood have considerable trouble from corrosion of copper tubes. The extract is concentrated in a vacuum evaporator. When the tubes begin to leak from corrosion, they are plugged up (to about seven in number) when the efficiency of the evaporator is so lowered that all tubes, good and bad, are cut out and replaced with an entire set of new tubes. The tubes which corrode are situated at no particular place in the evaporator, but occur at random. Can you give a reason why some of these tubes corrode very rapidly, while probably an adjoining tube which, apparently is subjected to identically the same influences, is not at all affected? What specifications would you recommend in order that we could secure tubes of a uniform wearing quality?

A.—If some of the copper tubes used in the vacuum evaporators for concentrating the chestnut wood extract are not corroded to any extent while others are corroded, it would seem that the tubes are not of uniform quality.

Copper tubes that are drawn from hollow ingots are frequently laminated and spongy and should, for this reason, be more readily attacked than dense solid tubes. Tensile tests will often detect these defective tubes. If tubes of sufficient length made from cross-rolled sheet copper by the cupping and drawing process can be secured they ought to be of more uniform quality than those made by the usual method. Where variations in hardness of the metal in the tubes exists it is possible for the hard and soft areas to act as galvanic couples and thus aid corrosion. Tubes that have been placed on mandrels and hammered all over have been said to have given remarkable service in marine condensers.

Possibly if every precaution were taken to secure dense sound tubes and these tubes were then given a light anneal to remove internal stress and finally hammered all over on a mandrel to obtain uniform hardness, an improvement in the life of tubes would be secured.—J. L. J. Problem 2,213.

DIPPING

Q.—Can you give me any information or do you know anything about Scotch or German soot being used in a bright acid dip to keep it cool?

A.—Scotch or German soot is used quite extensively in the production of acid dipped brass goods. The claims for the soot are that the acid keeps cooler under its influence. It is not used in the bright dip, but what is termed as the firing off or aqua fortis dip. This dip is used as the preliminary dip before immersing the articles in the regular bright dip consisting of sulphuric and nitric acid or aqua fortis and small proportions of muriatic acid or common salt.

You might try from ½ to 1 ounce per gallon of solution.—C. H. P. Problem 2,214.

DRIVING

Q. Can you inform us what is the cause of the belts on some of our machines having a tendency to climb up on to the larger step of the cone pulley? Sometimes the belt succeeds in climbing up and other times twists over on its edge, thus twisting it out of shape.

A.—The climbing of a belt or rubbing on edge of a step on pulley may result from one or many causes, and also from a combination of several. The two cones may not line up with one another, the belt may not be properly laced or an accumulation of grease adhering to the side of the cone. Also a poor grade of belting which has stretched and drawn at one side has been used. Care should be taken to keep the surface of cone pulleys as free from dirt as possible. All cone pulleys should be crowned and flanges undercut to reduce the friction. By this method the belt only has a bearing on the sides of the cone at two points. Proper attention to belts is one of the chief essentials to successful production.—P. W. B. Problem 2,215.

FINISHING

Q.—Kindly advise how to obtain a Roman gold finish on brass?

A.—Roman gold is sometimes imitated by immersing the brass or brass plated articles in a solution consisting of the following:

Water	1 gallon
Hyposulphite of soda	2 ounces
Acetate of lead	¼ to ½ ounce

The solution should be used hot and the articles will immediately turn a golden color. The articles should then be removed, dried and lacquered. If the solution is too strong the color will darken quite readily and a gray tone will develop. The solution can also be used for various colors if the proportions given are increased.

Roman gold lacquers are also used to produce Roman gold finish on brass.—C. H. P. Problem 2,216.

Q.—Will you let me know how to obtain a Swedish iron finish?

A.—The Swedish iron finish is produced as follows: The iron or steel should contain indentations or hammer marks to imitate the crudeness of manufacture. The articles containing these marks are then coated with a dead black japan or dead black lacquer and when thoroughly dry the japan or lacquer is polished off on emery wheels, using about 160 emery. Afterwards the articles are lacquered.

Or the articles may be finished down with 160 emery and then lacquered and when dry dead black lacquer should be brushed into the indentations and after a short time the excess of black should be wiped away from the plain surfaces with linseed oil, to which a little turpentine may be added.

Burnt brass is a similar finish only the iron or steel surface must be brass plated, lacquered and then a mixture of sienna or raw umber with a small amount of orange chrome should be mixed up with a little turpentine varnish, linseed oil and turpentine and applied in the same manner as the japalac.—C. H. P. Problem 2,217.

MELTING

Q.—Will you kindly give us the correct weights of copper, zinc and tin when charging to get 88 copper, 10 tin and 2 zinc (Admiralty gun metal)? We charge 88 pounds of copper in a new pot, then when the metal is nearly ready we put in 10 pounds of tin, and then just before drawing we put in 2 pounds of spelter. We use all new metal, but can only get a tensile strength of 12½ tons per square inch. Could you please tell us what to allow for waste?

A.—In making Admiralty gun metal the melting loss is about ¼ per cent. In re-melting this alloy a loss of about ½ per cent. should be allowed and this amount of zinc additional added. A tensile strength of at least 15 tons with a minimum elongation of 15 per cent. should be obtained.

In order to obtain maximum physical characteristics, careful melting is necessary and the addition of a small amount of phosphor copper or some other deoxidizer. The metal must be well alloyed and the test pieces should be gated in such a way that there are no porous spots or shrink spots in them.—J. L. J. Problem 2,218.

MIXING

Q.—Will you kindly favor us with the formula and the method of preparing XXXX nickel babbitt?

A.—We are not familiar with the specific brand of babbitt known as XXXX nickel babbitt. An analysis will give you the exact formula. The following is a babbitt of this class:

Lead	66
Antimony	20
Tin	10
Alloy	4

The alloy consists of tin 80 and nickel 20. It is open to question whether the addition of the nickel is a benefit to a babbitt. It is difficult to make a babbitt.—J. L. J. Problem 2,219.

POURING

Q.—Can you inform us how aluminum shot, or granulate, is made?

A.—We understand that aluminum shot is made by melting the metal and pouring it into water through a metal screen which contains suitable size holes, according to the size shot that it is required to make.—K. Problem 2,220.

SOLDERING

Q.—We are using old scrap pewter for making up tinman's solder and we are desirous of knowing how to get rid of the crystallized appearance on the surface of the strip which shows up when cool. Has the presence of antimony in the pewter anything to do with our not being able to get the bright surface, if so, what is the process to take out the antimony from the pewter?

A.—Pewter varies in composition within a considerable range, copper and antimony being the metals in it that would be most detrimental to a high grade tinman's solder and most likely to prevent your getting the desired bright surface. The following mixtures for pewter will show you the metals and the proportions used by certain makers:

Hard pewter—tin 12 ounces, antimony 1 ounce and copper 4 ounces.

Common pewter—tin 4 ounces, lead 1 ounce.

Best pewter—tin 6 pounds, 4 ounces, and antimony 1 pound, 1 ounce.

By melting the pewter in a sweating or liquating furnace at a low temperature excellent material for tinman's solder may be had and the remaining antimony and copper dross may be sold or used for making babbitt metal.—J. L. J. Problem 2,221.

TINNING

Q.—I should be glad if you could tell me what proportions of salts are used in a tinning solution composed of best brown potash and tin salts, and what is the proper current to use. I am using a solution that works milky and so I add potash, but then it works slowly. It stands at 15 degrees on a nickelometer. Can you tell me how I can make it work clear?

A.—In electro tin plating the best results are obtained from a solution of potassium hydrate, tin chloride and oxide of lead based upon the following proportions:

Water	1 gallon
Potassium hydrate	8 ounces
Oxide of lead	¼ ounce
Chloride of tin	2 ounces

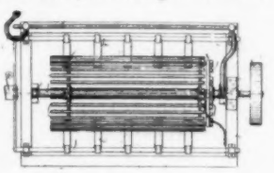
The solution should be maintained at a temperature of 160 to 180 degrees Fahrenheit. Anodes should consist of the best straits tin. The above proportions of potassium hydrate may be replaced with 6 to 8 ounces of the best brown potash you mention.—C. H. P. Problem 2,222.

PATENTS

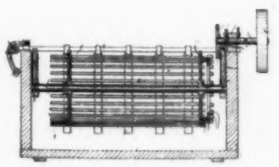
REVIEW OF CURRENT PATENTS OF INTEREST TO THE READERS OF THE METAL INDUSTRY

1,154,604. September 28, 1915. **Electro-plating Device.** H. R. Boissier, Great Neck, N. Y.

This invention relates to electro-plating and the improvements as herein shown in the cut, are embodied in an apparatus which is designed especially to facilitate the plating of rods, such as curtain rods, and the like; although some of the improvements are capable of a wider use.



The invention is covered by the following claims:

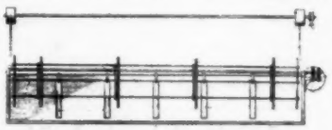


In an electro-plating device, a revoluble cathode - carrying frame or rack comprising a shaft; a pair of wheels secured to said shaft; a pair of wheels secured to said shaft; a plurality of springs secured to the rims of said wheels, all of said parts except said springs being covered with a coating of insulating material—whereby a plurality of rods or similar articles to be plated may be held in the plating solution and revolved with only the contact springs of the holding device subject to the action of the current.

An electro-plating device comprising a tank; a pair of socket pieces secured to inner opposite sides of said tank; a revoluble cathode-carrying rack or frame; bearing blocks for the axis of said frame—said bearing blocks being removably held in and supported by said socket pieces; a gear mounted on said frame concentric with its axis; a drive shaft mounted on said tank and a gear on said shaft—said drive shaft being slidable in its bearings to bring said gears into and out of mesh with each other.

1,154,660. September 28, 1915. **Plating Machine.** L. Schulte, Chicago Ill. Assignor to Electro Chemical Products Association of Chicago, Ill.

This invention relates to plating machines and has for its object the provision of a machine, as shown in cut, which may be advantageously used for the plating of sheets, bars, tubes or other sections of such a character.



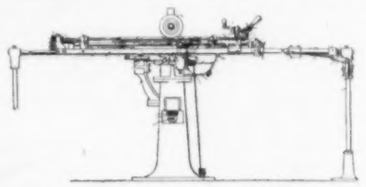
The invention is of such a character that the apparatus can be readily utilized to perform various cleaning, plating, washing and drying operations on devices above set forth in a most expeditious manner.

In one form of the invention to accomplish this result, a carrier is provided which can be successively inserted into a plurality of tanks, thus to perform the operations above outlined.

The invention contemplates further the continual movement of the device while in any given tank, the carrier apparatus being of such construction that when revolving in one given direction of rotation, it will continually rotate the devices, thus changing their position, while when being rotated in the opposite direction it will discharge the devices after the completion of the operations referred to.

1,154,696. September 28, 1915. **Polishing Machine.** J. F. Gail, Kenosha, Wis.

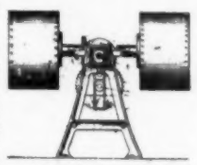
This invention relates to improvements in polishing machines and refers more particularly to a machine for polishing brass tubing, used in brass beds or other metal furniture and the like.



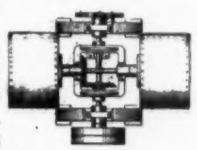
Among the salient objects of the invention are to provide a construction, as shown in cut, in which a series of tubes is simultaneously and automatically polished, the machine being so arranged as to insure a uniform polishing of the respective tubes; to provide a construction in which the tubes are mounted on a traveling carriage which is reciprocated back and forth beneath a revolving polishing wheel for a given number of reciprocations and in which the tubes are each partially turned on their axes during predetermined points in the travel of said carriage, the polishing wheel being rendered temporarily inoperative during said turning movement so as to prevent scratching of the surface of said tubes.

1,155,150. September 28, 1915. **Tumbling Barrel.** John Henderson, Waterbury, Conn.

This invention is an improvement in tumbling barrels and especially upon the tumbling barrel disclosed in the application for patent filed April 12, 1912, Serial Number 690,379.



In the present construction by employing gears with skewed teeth and running one shaft across the other the inventor is able to place all the spur gears for driving the device upon the outer side of a supporting stand in which position they do not limit the angle of oscillation as when otherwise mounted.

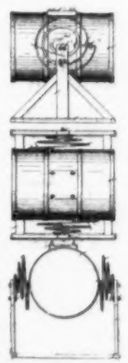


The present invention also embodies other improvements which are hereinafter described, pointed out in the claims and shown in the accompanying drawing.

The patent covers the combination with a combined rotating and oscillating shaft having a tumbling barrel at each end thereof, of a frame in which said shaft is journaled, a rotary shaft on which the frame is mounted, gearings arranged within the frame for rotating the tumbling barrel shaft, and gearing arranged without the frame, for oscillating said shaft.

1,155,579. October 5, 1915. **Tumbling Barrel.** A. C. Johnson, Omaha.

This invention relates to certain new and useful improvements in tumbling barrels, and relates more particularly to a barrel cylinder, or other receptacle, as shown in cut, which is used for the rumbling of castings, or for any other purpose in which an agitating action is desirable or necessary.



The object of the invention is to provide means for mounting the barrel, whereby same can be operated with the expenditure of minimum power so as to have universal movement, that is to say reciprocatory movement in a vertical and horizontal plane, as well as oscillatory movement in both a vertical and horizontal plane, so as to subject the articles or substance contained within the barrel to maximum agitation.

Further, the invention aims to provide a barrel mounting, in which, after initial operation thereof, the movement imparted to the barrel will continue throughout a short space of time, after which

further movement may be given the barrel, or if desired, positive movement may be continued as long as desired by the operator.

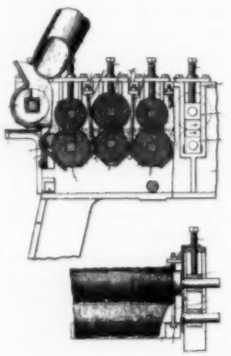
1,155,317. September 28, 1915. **Method of Applying Protective Coatings to Metallic Articles.** Clarence Mark, of Evanston, and Clayton Mark, Jr., of Lake Forest, Ill. Assignors to Clayton Mark, of Lake Forest, Ill.

This invention relates to methods of applying protective coatings to metallic articles, and consists in introducing the articles to be coated into a bath containing lead and zinc, or lead, tin and zinc in such proportions that when they are alloyed they are electro-positive to iron in an electrolyte, such as tap water, salt solutions or common conducting solutions other than nitrates, and in maintaining a suitable protective flux upon the bath.

The invention also consists in maintaining the bath at a temperature lower than the melting point of zinc and in the periodic addition of zinc which will be taken up by the bath so as to maintain constant the proportion of zinc in the alloy.

1,155,671. October 5, 1915. **Machine for Cleaning and Polishing Tin Sheets.** W. L. McKean, of Martin's Ferry, Ohio.

This invention covers a machine, as is shown in the cut, for the cleaning and polishing of tin plate. The patent includes the following claims:



1. In a machine for cleaning and polishing tin sheets, the combination of a plurality of spaced pairs of rolls, and means arranged between adjacent lower rolls for supporting cleaning material in the line of movement of the sheets through the machine.

2. In a machine for cleaning and polishing tin sheets, the combination of a plurality of pairs of rolls having yielding surfaces, and means for applying deforming pressure to the surfaces of the lower rolls at points below the axes of the rolls.

3. In a machine for cleaning and polishing tin plates, bars arranged intermediate adjacent lower rolls, and means for adjusting the positions of the bars relative to the rolls.

4. In a machine for cleaning and polishing tin sheets, the combination of a plurality of pairs of rolls, angle bars arranged intermediate adjacent lower rolls, and means for raising and lowering said angle bars.

1,155,974. October 5, 1915. **Treatment of Metals.** Tycho Van Aller, of Schenectady, N. Y. Assignor to General Electric Company, a corporation of New York.

This invention relates to the art of coating or otherwise treating metals so as to protect them against the effects of oxidation and other similar corrosive agencies and has for its object the production of a coating upon a metal normally subject to corrosive action or a condition within the metal such that it is capable of withstanding the oxidizing and corrosive influence without harmful effect.

This invention relates more specifically to the treatment of such metals as copper and iron which readily oxidize. As is well known, copper oxidizes very readily even at moderate temperatures. Iron, at moderate temperatures, oxidizes slowly if unprotected but at high temperatures the rate of oxidation is so rapid as to render its use almost prohibitive.

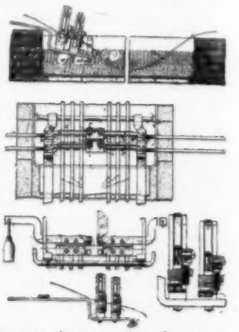
The inventor finds that metallic aluminum can be used to obtain the above object. He uses aluminum powder, zinc or graphite and sal ammoniac, and heats the metal to be treated in contact with this mixture to about 700° C.

1,156,093. October 12, 1915. **White Metal Casting and Method of Making.** Charles Pack, of New York. Assignor to the Doehler Die Casting Company, of the same place.

The invention consists primarily in a method of making finished white metal castings consisting in alloying from 80 to 91 per cent. of aluminum with from 20 to 9 per cent. of copper and delivering the molten alloy to a metallic mold maintained at a temperature below the fusing point of the alloy; and in the casting produced by this process; all as hereinafter set forth and described and more particularly pointed out in the claims hereto appended.

In the practice of the invention the inventor forms an alloy of aluminum and copper, the proportions of these metals varying according to the size and character of the casting to be made therefrom. He has found that for small simple castings, the aluminum and the copper may be alloyed in a proportion of 91 parts of aluminum to 9 parts of copper, but that it is desirable and necessary to increase the percentage of copper with castings larger in dimensions and more complicated in their configuration. The alloy containing the highest percentage of copper which he has been able to use successfully has been composed of 20 parts of copper and 80 parts of aluminum.

1,156,995. October 19, 1915. **Method of Coating Metal.** John A. Hanlon, of Pittsburgh, Pa. Assignor to Hanlon-Gregory Galvanizing Company, of Pittsburgh, Pa., a corporation of Pennsylvania.



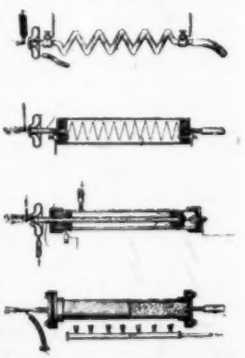
This invention relates to a method of coating metal, and particularly to a method of coating steel or iron with lead, zinc, or compositions thereof.

The object of the invention is to provide a method whereby strips of iron or steel may be provided with a very thin coating of metal applied in such manner that the coating metal is spread very evenly and forced into the pores of the base material, to form a firm and secure bond or physical connection therebetween, to enable the coated material to be bent or folded upon itself or at very sharp angles, without breaking, cracking, stripping or peeling of the coating metal.

To carry out the method an apparatus of suitable construction, as shown in the cut, is used.

1,157,984. October 26,1915. **Method of Melting and Spraying Fusible Substances.** Franz Herkenrath, of Zurich, Switzerland. Assignor, by Mesne Assignments, to Metals Coating Company of America, of Boston, Mass., a corporation of Massachusetts.

This invention relates to an improved method of melting and spraying fusible substances as required for the formation of adhering or detachable coatings made by the Schoop process described in application Serial No. 552,800.



To this end the inventor uses a stream of heated gas, in the path of which he places the fusible substance, the temperature of the gas being sufficiently high to melt the substance. The function of the gas is thus in part analogous to that of the blow pipe flame used in some forms of metal spraying but the gas also assists in subdividing the molten substance and projecting it at the requisite velocity to form an impacted coating. It is usually more economical to use a separate blast device acting in conjunction with the stream of hot gas as in such a case the required energy of spraying blast may be obtained without heating an excessive quantity of spraying gas.

Suitable apparatus for carrying this improved method into effect are shown in the accompanying drawings.

1,157,569. October 19, 1915. **Process of Plating or Decorating China or Glassware.** F. Moench, Rushville, Ill.

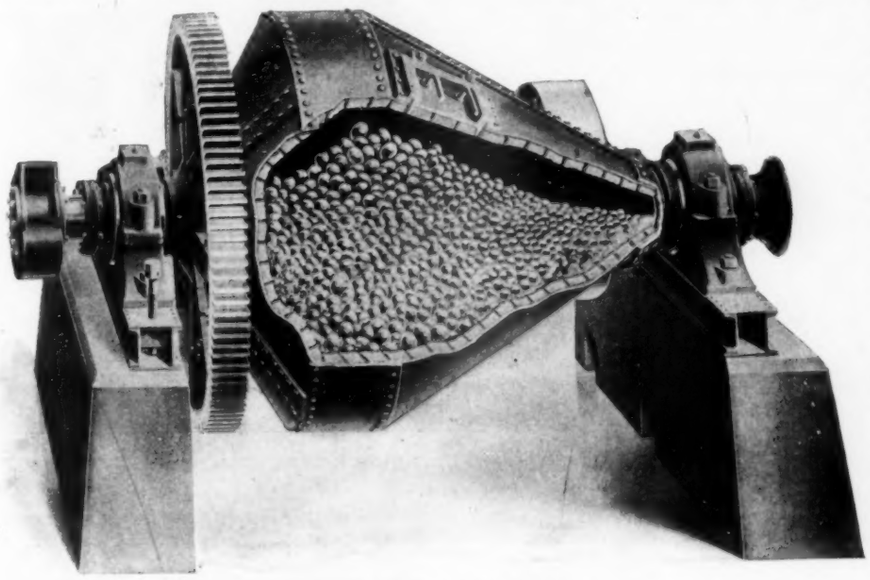
This patent covers the process of plating or decorating glass or ceramic ware, which consists in treating the surface to be decorated or plated with hydrofluoric acid, heating the objects to be plated, rubbing on the heated objects melted metal, and allowing the objects with the metal coat to cool gradually.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST TO THE READERS OF THE METAL INDUSTRY.

CONICAL BALL MILL

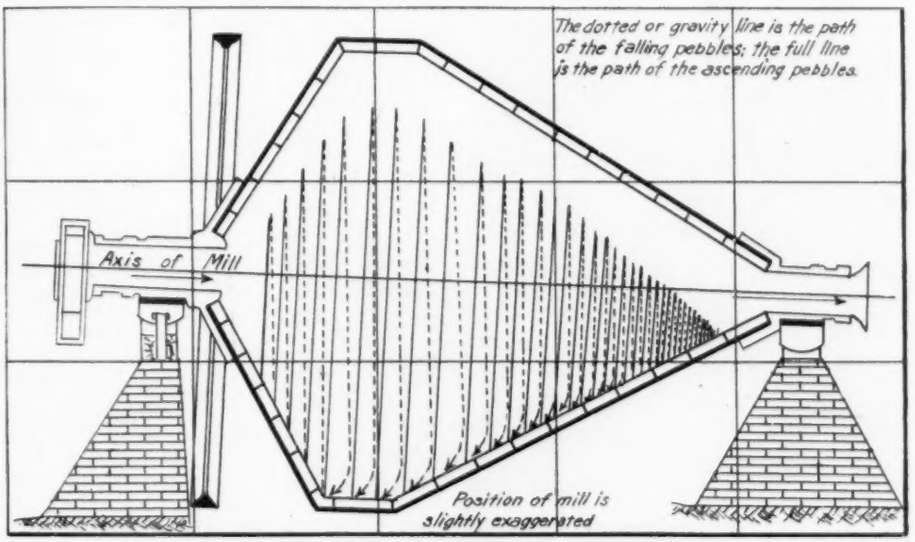
The mill shown in the cut has lately been introduced in the metal recovery department of brass mills and foundries. This mill, which is manufactured by the Hardinge Conical Mill Company, 50 Church street, New York, is claimed to be ideal because it has a small initial installation and maintenance cost, requires no skilled labor to operate, has no screens or casings, is accessible, crushes wet or dry, adjusts a large ball to crush a large particle and a small ball to crush a small particle. The partly crushed material is immeidately removed from the zone of action of the large balls and seeks a zone of balls that are suitable for the work, discharging from the mill as soon as it has reached the approximate size desired. The mill can be adjusted to deliver a ¼-inch, 8 or 10-mesh product without screening.



THE HARDINGE BALL MILL

The cut, Fig. 2, will give a very good idea of the manner in which the crushing balls travel and it can be readily seen that if the feed is properly adjusted the discharge of crushed material will be equal to the influx of new matter.

Among the concerns which are now using this machine as a part of their regular system to recover the metal which is contained in ashes and other waste material from the casting shop, include the Chase Rolling Mill Company, Waterbury, Conn.; Ajax Metal Company, Philadelphia, Pa.; White & Brother, Philadelphia, Pa.; the Balbach Smelting & Refining Company, Newark, N. J.; United States Nickel Company, New Brunswick, N. J., and many others. Full information may be had of this machine and process by corresponding with the Hardinge Conical Mill Company as above and asking for catalog No. 6.



THE FINE LINES SHOW THE PATH TRAVELED BY THE BALLS

BEARING METALS

The white metal department of the Michigan Smelting and Refining Company, Detroit, Mich., have the following to say in reference to bearing metals:

A bearing metal that will perform the service requirements of absolutely any machinery and at the same time save more than sixty per cent. initial cost, fifty per cent. of installation expense and immense saving in lubrication, surely deserves the serious consideration of every man engaged in building, operating or repairing machinery, regardless of the kind, size or service for in the end and after all there is but one definite service required of bearing metals, that is to take care of the vital parts of all machinery (the bearings) with the minimum of friction and maximum life of the bearings. This cannot be accomplished with metal that is too hard or too soft. One increases friction, heat and wear, while the other may not stand the load-weight or speeds but mash or squeeze out, or disintegrate, so there must be a "happy medium," an ideal evolved from experience, practice and common sense. To reach that ideal is a simple solution of the mechanical problem of what is the limit of load-weight to which the bearing of any machinery may be carried. The limit that every intelligent mechanic knows and which every builder of machinery figures carefully in his construction plans. That limit cannot exceed 2,500 pounds load-weight to the square inch of bearing metal without disastrous results to the machinery, by either stalling the machine, destroying the bearings, breaking the belts or wrecking the weaker parts of the machine.

It can be demonstrated by investigation that seventy-five per cent. of the machinery in operation does not carry as much as

1,500 pounds load-weight to the square inch of metal in the bearings. Now if a metal in the bearings is strong enough, tough enough and sufficiently cohesive to carry the load without mashing, and at the same time it is soft enough to give the minimum of friction in the bearings, where is the need of a harder metal simply because it is harder and costs more on account of the hardening metals in its composition?

No man can successfully controvert the statement made by America's greatest metallurgist many years ago, the statement "That metal is best for bearings that is the softest, and at the same time tough enough and cohesive enough to stand the load-weight limit of properly constructed machinery." This same man, after buying millions of dollars' worth of hard metal bearings for railway service, by which millions of dollars of loss ensued, found by investigation how much he had been in error, then adopted the other extreme which wholly converted him and brought forth the above statement.

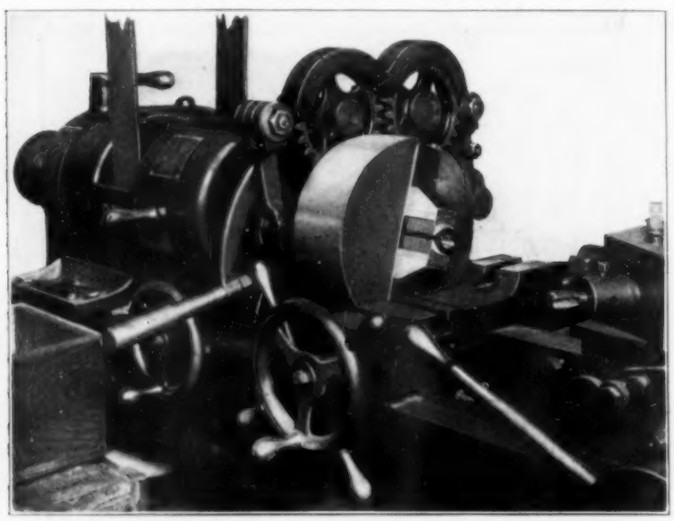
Perhaps more has been written on the bearing metal subject than any other in connection with metallurgy, and still a large per cent. of users are right where we started more than 50 years ago when Isaac Babbitt, without experience, precedent, or even metallurgical knowledge, applied the use of tin hardened with antimony and copper to machinery bearings for the purpose of reducing friction caused by the contact of two hard metals, steel and iron. In those days a cast iron bearing, the length of which was the same as the diameter of the shaft, was considered correct mechanical practice, and the now so-called genuine babbitt metal was of course an improvement as it was softer than the iron bearing, and strong enough to stay where they put it, but with improved construction following a fixed rule of making the length of the bearing three times the diameter of the shaft, plays the necessary part in reducing the load-weight limit to the correct basis for carrying the proper metal, and any other mixture is simply a waste of money if it costs more, and a dead loss if it costs less.

The best bearing metal in the world today can be made and sold for less than half the cost of that which enters into the construction and repairs of fully half the machinery used. Practical demonstration will prove that statement and surely the possible saving is worth the trouble of investigation.

WRENCHLESS CHUCKS

The chucks shown in the cuts were developed to meet the demand of progressive manufacturers for a chuck that would not require the installation of an expensive air plant for its operation.

The jaws slide in suitable ways the same as any air chuck,

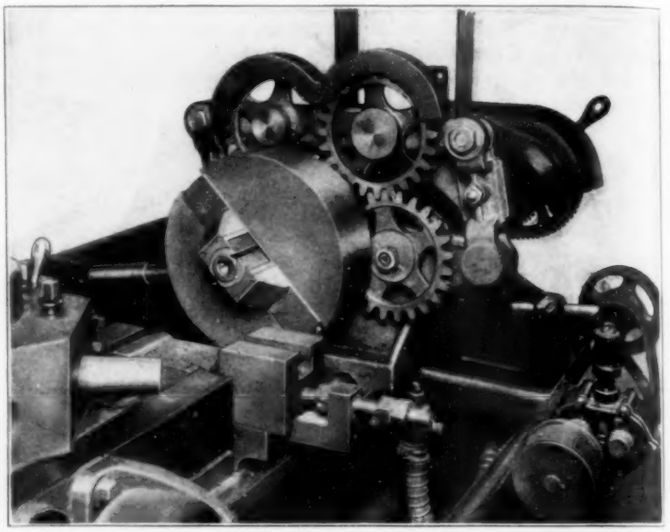


THE WRENCHLESS CHUCK.

but otherwise the chuck is a radical departure from anything yet produced in the wrenchless chuck line. Although it possesses many novel and original features a short statement will suffice to make its operation fully understood by the average mechanic.

The opening and closing of the jaws is accomplished by a set of gears constantly in mesh, two of which are mounted on a swinging arm to which the hand lever is attached. Moving this lever advances or retards a cam within the chuck shell and acting through suitable levers, opens and closes the jaws as desired, while the lathe is either in motion or at rest. The cam is so shaped that the initial closing movement of the jaws is very rapid, but at the finish is slow and powerful and will hold the work against the most severe shaping tools. A movement of the hand lever of about 25 degrees throws the jaws from full release to full contact.

High speeds do not affect the operation of the chuck whatever, as the centrifugal force of the jaws is perfectly counterbalanced



THE WRENCHLESS CHUCK SHOWING THE GEARS THAT WORK THE JAWS.

by the levers within the shell. The lathe may be reversed for backing off threads, etc., without in any way lessening its effectiveness.

The advantages of the chuck over all other forms of wrenchless chucks are claimed to be many, the most important of which probably is the direct saving effected by the elimination of the cost of the air compressor, pipe system, valves, etc., and their installation, together with the unending costs of maintenance and the pumping of air, a saving that can hardly be overestimated.

This chuck is manufactured by the Thomas Elevator Company, South Hoyne avenue, Chicago, Ill.

METAL CYANIDES

The Roessler & Hasslacher Chemical Company, New York, N. Y., have issued a new booklet on the "Economy of the Metal Cyanides." It is believed by the company that the data contained in the booklet will conclusively prove to the plating trade the claims made that the metal cyanides are not only the most efficient, but most economical metal salts for plating purposes.

A very valuable feature of this booklet is the publication in it of formulae for the various solutions that it is possible to make up by the use of metal cyanides. These formulae are contained under the head of "Directions for Use," and are as follows:

DIRECTIONS FOR USE.

The following are standard recipes for still solutions which should be changed according to conditions governing the individual needs:

COPPER SOLUTION.

Water	1 gal.
Sodium cyanide, 129%	3⅛ ozs.
Copper cyanide	3 ozs.
Soda ash	½ oz.

Such a solution worked at a normal temperature at 3 volts will give excellent results. To make up a new solution fill the tank with water and in a separate crock dissolve the above ingredi-

ents in about one-sixth the total amount of water which has been previously heated. After the salts are all dissolved, add this concentrated solution to the water in the main tank.

For replenishing solutions, dissolve equal parts of sodium cyanide, 129 per cent., and copper cyanide in a small quantity of water heated to about 180 degs. F. When the same is all dissolved, add this to the solution that is to be replenished.

The above instructions also apply to the following solutions:

BRASS SOLUTION.

Water	1 gal.
Sodium cyanide, 129%	4½ ozs.
Copper cyanide	3 ozs.
Zinc cyanide	1 oz.
Ammonium chloride	⅓ oz.
Soda ash	1 oz.

ZINC SOLUTION.

Water	1 gal.
Sodium cyanide, 129%	4 ozs.
Zinc cyanide	6 ozs.
Ammonium chloride	2 ozs.

SILVER SOLUTION.

Water	1 gal.
Sodium cyanide, 129%	3½ ozs.
Silver cyanide	2½ ozs.
Ammonium chloride	⅓ oz.

The proportions given in the above recipes can be increased or decreased according to the special requirements and the metal content required for certain work. Copies of this booklet may be had upon request.

A NOTABLE LEATHER BELTING EXHIBIT

Among the exhibits of special interest to manufacturers in the Palace of Machinery at the Panama-Pacific International Exposition, is that of the Chas. A. Schieren Company of New York City, who present a unique exhibit of leather belting running on different types of belt drives.

There are many accepted ways of laying out belt drives, i. e.:

EXHIBIT OF CHAS A. SCHIEREN COMPANY OF NEW YORK AT PANAMA EXPOSITION, SAN FRANCISCO, CAL.

1. The simple horizontal drive with the pulling of the belt on the lower side of the pulley.
2. The familiar quarter turn drive.
3. The method of driving from one shaft to another laid at right angles to each other.
4. The various drives contrived with belt tighteners.
5. The familiar "Mule Drive," i. e., laid out with two idlers with the belt running between two shafts not parallel, etc.

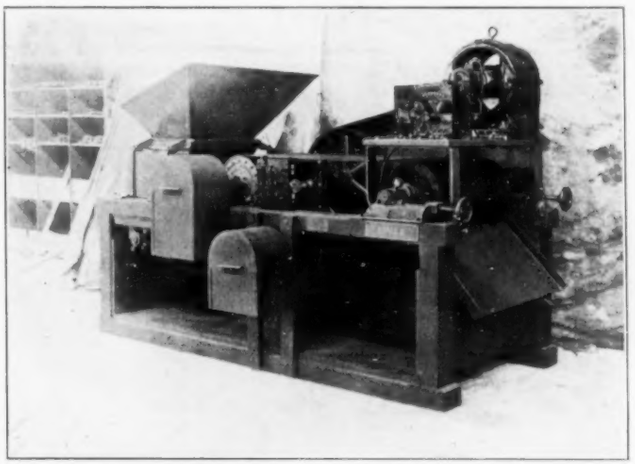
The above drives are all exemplified in the exhibit, and this interesting collection of drives are all shown in motion. For this purpose the Schieren pavilion was especially built of steel throughout. The structure is strong and rigid, and at the same time artistic in design. It is supported on four massive steel columns, each weighing about a ton. The cornice, roof trusses and floor supports are of heavy steel construction so as to prevent any vibration from the running machinery.

The lighting scheme gives a brilliant illumination to the belt drives illustrated, while the beautiful fountain plays in the center of the pavilion and directs attention to the "Duxbak" waterproof belting running under water in the basin,

The representative in charge of this exhibit is Mr. Carl E. Basler, who speaks several languages. Mr. Basler has "girdled" the globe. And visitors from any country can readily have "Duxbak" belting and the other products of this house fully set forth by him.

DINGS MAGNETIC SEPARATOR

Equipment used in the great plant of the Ford Motor Company, Detroit, is always of interest to the public. Among the interesting features in the Ford brass foundry is a new magnetic separator built by the Dings Electro-Magnetic Separator Company, Milwaukee. The accompanying cut is from a photo print



THE DINGS SEPARATOR

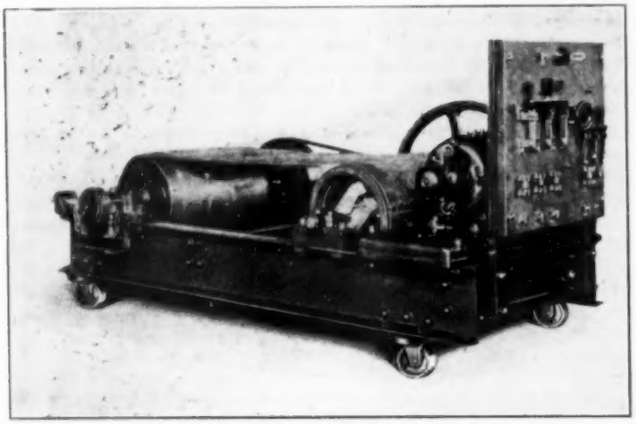
of this machine. The separator is motor-driven. All exposed moving parts are carefully protected in accordance with the "Safety First" movement. This machine is designated by the builders as Type DA. It gives the metal two different treatments. First by passing under an agitated magnetic field and then over a pulley magnet. The advantages claimed for this separator are large capacity and clean products with little loss of brass in the iron tailings due to mechanical entrainment.

NEW PORTABLE MAGNETIC SEPARATOR OUTFIT

The accompanying illustration shows an interesting portable magnetic separating outfit built for the Graphite Lubricated Bearing Company, Boundbrook, N. J., by the Cutler-Hammer Clutch Company, Milwaukee, Wis. The separator is used for removing magnetic content from brass in various parts of the plant. The outfit is moved to where a separation is to be made and the material conveyed onto the belt. The brass is projected beyond the pulley freed from magnetic pieces, since the latter hug the belt in passing over the magnetized pulley and are dropped below where the belt leaves the pulley.

The direct current for the magnetic pulley is furnished by the small 110-volt generator which is driven by the same induction

motor that drives the pulley. The small panel mounted at one end of the frame carries the three-pole motor knife switch and



THE PORTABLE MAGNETIC SEPARATOR

fuses, the double-pole generator knife switch and fuses, back-of-board dynamo-field regulator and pilot lamp.

MAX AMS MACHINE COMPANY'S NEW PLANT

The Max Ams Machine Company, Mount Vernon, N. Y., manufacturers of power presses and complete lines of sanitary

NEW PLANT OF MAX AMS CO. AT BRIDGEPORT, CONN.

can machinery, have moved to their new and enlarged plant at Bridgeport, Conn. The company has a large and growing export trade which is handled through its representatives in Japan, China, India, Australia, South Africa, South America, England and the European continent. The area of the new site is approximately 15 acres, and is situated on the main line of the New York, New Haven & Hartford R. R., in the vicinity of Fairfield. The main shop and adjacent sawtooth sections, practically all steel construction, is equipped with every modern tool and device to facilitate the handling of the output that the progress of the industry requires.

The main erecting shop has a double balcony extending the entire length of the building leaving the center entirely clear for the conveyance of large units to the railroad sidings, which run into the plant. When preparations are complete the company will employ about 400 men, mostly skilled mechanics. Every known means to insure the protection and comfort of the employees will be provided. Baseball grounds and other means for recreation are now under consideration. The executive staff in part are: Charles M. Ams, president; Julius Brenzinger, vice-president; James T. Connor, assistant general manager.

"SAFETY FIRST" BELT SHIFTER

The belt shifter shown in the cut is made by the Ready Tool Company, of Bridgeport, Conn., and as will be seen not only saves time where the employee generally has to run around and find a ladder but furnishes an absolutely safe means of shifting belts and throwing them on and off pulleys in motion. It is made to comply with the various state compensation acts in preventing accidents and should be used in every factory having belts.

The device consists of one part to be bolted on to the regulation pole, having a swivel fork attached. There are three rollers, two of them being tapered, so that there is no possibility of the hook getting caught, and no way in which the belt can bind against the various parts. Two of the rolls being tapered after the belt is placed in the fork the tendency is at all times for the belt to slide on to the pulley and for the forks to slide away overcoming entirely any possibility of accident.

It is substantially made and can always be depended upon to throw on any but main belts without danger and without requiring the power to be stopped.

HARDWOOD CHARCOAL

The Phipps Charcoal Company of Ironton, Ohio, state that they are manufacturers and millers of the genuine Pit-burnt

SAFETY FIRST BELT SHIFTER

Hardwood Charcoal, which is recognized as the purest charcoal possible to obtain. It is burned from the same woods and by the same process as that employed 55 years ago for the charcoal used in the manufacture of the famous Ironton charcoal-iron, from which was cast the "Swamp Angel" and other large cannon used in the Civil War.

In a recent competitive test of various charcoals by the Bureau of Explosives, the product of the Phipps Charcoal Company showed an abnormally large content of carbon, which is the vital element of charcoal, with a correspondingly small proportion of moisture, volatile organic matter, etc.

ASSOCIATIONS AND SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE METAL INDUSTRY ORGANIZATIONS.

AMERICAN ELECTRO-PLATERS' SOCIETY

Philadelphia Branch—Philip Uhl, secretary, 2432 North 29th street, Philadelphia, Pa.

The monthly meeting of this branch held on Friday, November 5, at the Harrison Building, University of Pennsylvania, 34th and Spruce streets, Philadelphia, Pa., was an open one to all platers. Dr. H. S. Lukens, instructor of electro-chemistry at the University of Pennsylvania, gave a lecture on the electro-deposition of nickel.

New York Branch—H. H. Reama, president, and Wm. Fischer, secretary, 345 East 23rd street, New York.

The regular monthly meeting of the New York Branch was held at their rooms, 256 Pearl street, New York, on Friday, October 22, with President Reama presiding. The laboratory committee continued their work demonstrating the making up of a silver solution and at the next meeting will be demonstrated the method used in determining the metallic content of a silver solution.

Cleveland Branch—Charles Werft, secretary, 331 Strathmore avenue, Cleveland, Ohio.

The Cleveland Branch held its regular monthly meeting on October 30 at the Central Y. M. C. A., 22nd street and Prospect avenue, Cleveland, Ohio, at which time a number of applications for membership from platers were received. Fehren Wadsworth, of Elyria, Ohio, read a paper on "Plating Die Castings," which dealt practically with the cleaning of the die castings.

Newark Branch—Edward W. T. Faint, president, and George Reuter, Jr., secretary, 175 South 11th street, Newark, N. J.

This branch held a very successful meeting on the night of Friday, November 5, at their laboratory, at which a number of papers were presented and discussed on the electro-deposition of metals. There was also given a practical demonstration and lecture on the metal cyanides, which attracted a great deal of attention.

Detroit Branch—B. E. Miller, secretary, 543 Townsend avenue, Detroit, Mich.

At the October meeting of this branch H. J. Hawkins was elected to honorary membership in recognition of the services he has rendered the branch and T. C. Eichstaedt read a paper on the subject of "Lighting Fixtures and Their Finishes." The branch has succeeded in entering a class of chemistry at the Public School and the first lesson will be devoted to the determination of nickel in nickel solutions. The branch extends an invitation to electro-platers living in Detroit and its suburbs to attend its meetings.

St. Louis Branch—H. H. Williams, president, and F. C. Rushton, secretary, 4405 Blair avenue, St. Louis, Mo.

At the last meeting of this branch, held at the Public Library Club Room, St. Louis, Mo., on October 23, the main feature of discussion was the establishing of a chemistry class and a majority of the members were in favor of establishing a laboratory to belong to the society with tanks, generators, etc., for practical experiments. A special meeting was also held at the home of H. H. Williams, 2134 Nebraska avenue, on October 30, at which time arrangements were made for the annual banquet.

Toronto Branch—E. Coles, secretary, P. O. Box 5, Coleman, Ontario, Canada.

The regular meeting of the Toronto Branch was held in Occident Hall on October 28, and after the regular business had been disposed of a paper on "Solutions in General" was presented by John Young, who covered the wide range of work handled in his daily work. The platers' class in the Technical School has opened for the winter, the members meeting twice a week for instruction in chemistry until the arrival of the generator which has been obtained when practical plating will be possible.

PERSONALS

ITEMS OF INTEREST TO THE INDIVIDUAL.

J. F. Wade has resigned as superintendent of the New Departure Manufacturing Company, Bristol, Conn., to become associated with the Bristol Brass Company, Bristol, Conn. He is succeeded by Frank C. Wilcox.

William Westerman, superintendent of the Coe Brass Company branch of the American Brass Company, Ansonia, Conn., has resigned after thirty-two years' service with the company. He will become manager of the rolling mills of the Western Cartridge Company, Alton, Ill.

George B. Hogaboom recently severed his connection with the plating department of the P. & F. Corbin Branch of the American Hardware Company, New Britain, Conn., and has taken charge of the plating department of Factory E, of the International Silver Company, Meriden, Conn.

William J. Pettis, Willow street, Waterbury, Conn., recently resigned his position as foreman of the casting department of the Randolph-Clowes Company, with which firm he had been connected for the past twenty years. Mr. Pettis has become connected with the National Brass and Copper Company at Lisbon, Ohio, where he will be assistant to the president in the operating department.

The estate of Charles M. Hall, father of the aluminum industry in this country, and later vice-president of the Aluminum Company of America, amounts to a little less than $10,000,000, according to an inventory of the estate filed with County Surrogate Judge Fish at Lockport, N. Y. The exact figures are $9,778,235.47, or more than $4,000,000 more than the estimate which was made at the time the will was filed for probate, more than a year ago.

DEATHS

Henry C. Shaw, vice-president of the A. Garrison Foundry Company, Pittsburgh, Pa., died on September 26 at his home in that city.

Jacob B. Fricker, Reading, Pa., died October 18, aged 76 years. He was president of the Reading Hardware Company and Crescent Brass Manufacturing Company, and was interested in a number of other manufacturing enterprises. He was also a builder and had erected more than 1,000 dwellings and other structures in Reading.

Wirt du Vivier Tassin, for many years Chief Chemist and Assistant Curator of the Division of Mineralogy of the National Museum, died at Washington, D. C., November 2, of heart disease.

He was born in Fort Whipple, Va., and was in his forty-seventh year. Mr. Tassin was a graduate of the Universities of Cornell and Harvard, and after graduation engaged in applied chemistry. After this he became special agent of the United States Geological Survey at the Chicago Exposition, and in 1893 was appointed chemist and assistant curator of the division of mineralogy of the United States National Museum, where he remained until 1909. Since that time Mr. Tassin had been a consulting metallurgist and chemical engineer.

He was a member of the American Chemical Society, the American Society for Testing Materials, and a number of others. Mr. Tassin was a member of the Cosmos Club of Washington. He was the author of papers on mineralogic and meteoric chemistry, characters of minerals, gems and precious stones, metallography, metallurgy, and the heat treatment of metals, as well as a contributor to THE METAL INDUSTRY.

TRADE NEWS

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS AND TRADE ITEMS OF INTEREST FROM THE DIFFERENT INDUSTRIAL CENTERS OF THE WORLD.

WATERBURY, CONN.

NOVEMBER 8, 1915.

Industry hums and business continues to expand throughout the Naugatuck valley, but the strike evil seems not to have disappeared. There now are some 150 men, who were employed at the Rogers and Brother silver factory, called the "Spoon" shop, on strike. They went out Thursday morning, because General Manager George Rockwell refused to grant demands for an eight-hour day, time and a half for overtime and twenty-five per cent. increase in wages. Mr. Rockwell declared that the company might be disposed to grant them a fifty-five hour week and ten per cent. increase, but the strike was called. The women employees stayed at work. This plant was one of the pioneer plants of this State to adopt a broad plan pension system which went into operation several months ago and it has always been considered a good place to work. The strike is one of the branch strikes of the employees of the International Silver Company and the Meriden headquarters is believed to be managing the affair.

In all the big brass factories new high records are being made for production and there seems to be plenty of such work ahead for months. The Scoville Manufacturing Company, whose business on goods for "war uses has been remarkable for the past year, is as busy as ever and apparently has settled its labor troubles satisfactorily. The American Brass Company is not only running at about full capacity but is rapidly extending its already large plant and is working its Torrington, Ansonia and all the local branches under pressure. Much work had to be turned over to the Kenosha, Wis., plant a few weeks back owing to a shaft break in the Benedict and Burnham Branch, but that is the only setback that has happened. This Company is not only busy on its own orders but is turning out large orders of brass for some of its competitors, such as the Scoville Manufacturing Company, according to reports.

The Chase Rolling Mills, Chase Metal Works and the Waterbury Manufacturing Company, likewise, are running full blast and will be busy all winter. The Chase Metal Works is still being extended as a result of the work of these great brass mills, the New Haven Railroad is getting on its feet, unprecedented records in tonnage are being made weekly, and the hauling in not a few cases is "long distance." So that it is seen that railroad business generally, is greatly profited by the industries hereabouts.

The Scovill Manufacturing Company paid an extra dividend of five per cent., closing the books on October 30, and more extra dividends are expected. Its stock was quoted this week $425 bid, $440 asked, and there are reports that some stock has been sold at $480. The workmen received an advance in overtime to the time and a half rate. This applies to all hands.

The American Brass Company stock has been affected by rumors of a plan to buy out the Bristol Brass Company, one of the fastest growing small concerns in the East. The story has been denied point blank by John P. Elton, yet it will not surprise many if the combination is completed within a year or two.

In the smaller plans throughout this section business is making new records, though it is not true that everywhere there is great prosperity. Some lines are about normal, clock and watch business is slow, novelties and sundry brass products are enjoying good demand and practically all kinds of labor is scarce. Some of the factories are working certain shifts overtime for the purpose of getting ahead enough so that the employees may be given three holidays beginning with Thanksgiving day, in old home week. Others will close only one day.—F. B. F.

BRIDGEPORT, CONN.

NOVEMBER 8, 1915.

Bridgeport has settled down to business after a succession of strikes that caused more excitement in the other 47 states of the Union than in Connecticut. Until today there has been peace in labor circles, but 160 metal workers at the Remington Arms and Ammunition Company left work today, claiming that the agreements entered into last summer have not been lived up to fully.

There is not an idle manufacturing plant in town, and about 80 per cent. of the factories, metal and otherwise, are working nights, on the three eight-hour shift plan. The war prosperity has in a measure transformed the lives of about 40 per cent. of the city's population.

Thousands of workers pour out of the factories every night at 11 o'clock, while other thousands await outside, dinner pails on arm in noon-day fashion, awaiting an opportunity to get to the tireless machines which are running at extra capacity to supply the Allies with munitions. The theatres near the manufacturing section have taken to the idea of running a morning matinee for the benefit of the night workers, and all have found that it paid well.

The big plant of the Arms company is practically finished. Factory organizations, embracing employes of practically every department, are getting plenty of space in the newspapers. The company put out a baseball team that captured the city championship with ease, and now has a football team that will be champions of the state. Bowling leagues have been started and tennis courts provided, so that there is a congenial pastime open to everyone in the firm's employ.

Good machinists, ironworkers, and tradesmen in similar lines can find work aplenty in this city at any time now. There is no decrease in the demand for skilled labor, particularly at the Arms company, and at the Union Metallic Cartridge company.—E. C. D.

NEW BRITAIN, CONN.

NOVEMBER 8, 1915.

The clouds of labor trouble which last month were piled high on the manufacturing horizon in New Britain have now blown away and business has once more settled down to almost normal proportions. The big strike which completely crippled the Vulcan Iron Works, compelling that factory to issue a notice that it would close down indefinitely, has been settled and the men have once more returned to work. The Corbin Screw Corporation, a division of the American Hardware Corporation, which was on the verge of a complete shut-down when over 1,200 of the 1,800 hands employed struck for higher wages, is once more assuming normal proportions, the strike having been successfully arbitrated by Manager Charles A. Glover and Mayor George A. Quigley. All of the strikers were permitted

to return to work with the exception of a single man who was the chief organizer. Even after the other strikes had been settled, including the strike at North & Judd's, the Corbin Annex and the Corbin Cabinet Lock and the P. & F. Corbin factories, the machinists at the New Britain Machine Company remained out.

About 600 skilled hands were included in this strike and when three weeks had rolled by and neither side had shown any willingness to settle, fully half of this number are said to have left the city and gone to other places where they secured employment. During the latter part of the week ending October 23, however, the strike came to a sudden termination following a conference of the leaders and the manufacturers. The only concession made by the manufacturers was to recognize the Machinists' Union card at the factory, there being no raises given except in deserving cases. The machinists agreed to the settlement but state that next spring they will be even more strongly organized and will repeat their demands. Thus, after about four weeks of a general strike, the biggest that ever visited this city, everything has been amicably settled and the wheels of industry are buzzing as before.

In a business way things in New Britain are fairly prosperous. The New Britain Machine Company has large orders, as has North & Judd's. At the last named concern a new addition is rapidly nearing completion. A large new factory building being erected by the Union Manufacturing Company, is also nearing completion. At Landers, Frary & Clark business is really rushing and some departments are working until 8 and 9 o'clock at night. That this company has large orders and that a boom is anticipated by those who know is evidenced by the sudden jump taken in the stock the latter part of October. During the one day, October 27, the stock opened at 57 and closed at 64, with 66 asked. There is a rumor to the effect that the business is such that an extra dividend of 4 per cent. is about to be declared.

The Hartford Auto Parts Company, a recent acquisition from Hartford, will move to this city in the near future, their new factory being well under way.

Of the so-called local stocks, the Bristol Brass Company, a concern located a few miles outside of New Britain, is showing a remarkable burst of prosperity. During the past four months the value of the stock has about doubled and the output of the factory has also been doubled. At present a large addition to the rolling mill is being erected.

Indications are at the present time that the coming winter is going to be a fairly busy one and that the near future promises a wave of great prosperity.—H. R. J.

MERIDEN, CONN.

NOVEMBER 8, 1915.

Meriden has had less strikes and labor troubles possibly than any other New England manufacturing city. This statement held good until early October of the present year. Today one out of every dozen people living here is out on a strike. This means that there are about 3,500 strikers, all employees of the International Silver Company's factories, including the glass cutters at the Wilcox Silver Plate Company, the Meriden Cut Glass Company as well as the factories known as the Barbour Silver Company, the Forbes Company, the Meriden Brittannia Works and Manning & Bowman.

The demands of the strikers are numerous. They demand ten per cent. increase in pay, improved factory conditions, time and one-half pay for Saturday afternoon overtime and double time for all Sunday and holiday work. They also demand that each department have a grievance committee. It is said that President George H. Wilcox has agreed to grant an increase in pay after January 1, but it has been refused. It is likewise reported that a conciliation committee from New York has been in the city and has decided that the company is not in a position to grant the several demands. In explanation: the better factory conditions demanded are fewer high priced foremen and more pay to the bench worker; a grievance committee to which any disgruntled employee may make demands and they in turn take up the matter with the officials. The Meriden strikers have threatened to call a general strike which would include the factories in Derby, Waterbury and Bridgeport.

The strike has been in progress for a month and seems no nearer a settlement than when first called, and President Wilcox is quoted as saying that he will not, and cannot accede to the demands made upon him.

Of the workmen employed by the International Silver Company, it may be said that in their ability as mechanics and in the qualities that make for good citizenship, their grade is of the highest.—H. R. J.

HARTFORD, CONN.

NOVEMBER 8, 1915.

The past month has seen no let-up in the boom that Hartford factories have enjoyed now for several months. Were it not for the strikes, it could be said that the metal industries have never been busier than they are today. Colt's Patent Firearms Manufacturing Company, employing 1,200 hands, leads in output, having war contracts on hand at present that aggregate $30,000,000. This means that the enlarged plant will be run to the full capacity all of the year 1916, at least. It is estimated that its first war order was a $5,000,000 one, while, about two weeks ago, another was received for $16,000, the third order bringing the total to the amount mentioned. In addition to the rapid fire guns which the company is making, it has a large order for automatic pistols from the Greek government.

The company is moving into the old West Armory as rapidly as possible. Of the four concerns occupying the place at the time the Colt Company decided to make use of it for its own business, the Asa F. Cook Company and the Hartford Auto Parts Company, are still to move, the former going into a new building which it has erected on Franklin avenue and the latter to New Britain, within two weeks.

The Pratt & Whitney Manufacturing Company plants are practically at a standstill, despite the fact that the firm is rushed, as never before, with orders coming indirectly from the Allies. Almost the entire working force was depleted when between 1,200 and 1,500 of the men went out on strike, their demands for an eight-hour day, instead of the present nine-hour schedule, being denied. The strikers declare that there are more than 2,000 men out on strike, but this is denied by the company. Several attempts have been made to settle the situation, but all have been to no avail, Works Manager B. M. W. Hanson refusing to see committees of workmen, citizens and business men. Mayor Joseph H. Lawler requested him, October 14, to see a committee of citizens which he would appoint. It was denied flatly. A week later, President Louis R. Cheney of the Hartford Chamber of Commerce, made a similar offer, volunteering to designate a suitable committee of well-known business men. This too was rejected. Now the company plans to post a notice to the effect that all of those former employees who do not return to their work before a specified time, will no longer be considered employees of the firm and steps will be taken to have their places filled by others. Fortunately, there have been no serious disturbances as a result of the strike.

At a meeting of the stockholders of Billings & Spencer Company of Hartford, October 27, it was voted to change the name of the firm to "The Billings & Spencer Company" and to increase the capital stock from $200,000 to $300,000, authorizing the board of directors to make a still further increase to a total of $500,000. All the officers and directors of the old company were re-elected, as follows: president, Charles E. Billings; vice-president, Frederick C. Billings; treasurer, Lewis D. Parker; secretary, Eben H. Stocker; assistant secretary and treasurer, Frank H. Stocker. Besides these officers, the board of directors, consists of C. M. Spencer, Fred P. Holt and Silas Chapman, Jr. The Billings & Spencer Company manufactures steel tools. Its officers have denied a report to the effect that they are contemplating removal to the abandoned factory buildings of the American Bridge Company in East Berlin, Conn.

The Royal Typewriter Company has received one of the largest orders from England ever given to a typewriter concern, and the factory has been put on a weekly schedule of sixty-three hours, which will later be increased to sixty-nine hours, a gain of between twelve and eighteen hours a week. It is expected that the rush will keep the employees working on that basis for five or six months. Since a considerable increase in orders has been evident the factory has been running six days a week, instead of on part time, as was the case following the outbreak of the European war. Notices have been posted canceling the

annual vacation usually given the employees in August. Charles B. Cook, vice-president and general manager of the company, says that business with Russia and South American countries exceeds that ever done before, and that in the domestic trade the company is behind in filling orders. Mr. Cook branded as false all reports that the Royal Typewriter Company had accepted large contracts for manufacturing fuses for explosives and other war materials. He said the company was not equipped with the proper machinery to do this and that it was more than it could do to handle its regular business.

The Maxim Silencer Company, one of the present tenants of the old West Armory of Colt's Patent Fire Arms Manufacturing Company, has completed arrangements for moving into the second story of a new building erected by Reinhold Hakewessell, Homestead avenue. While the new quarters are about the same as the old, measuring roughly about 5,400 square feet, the move will signalize an increase in the plant, as it is stipulated in the contract that an addition will be built upon three months' notice by the tenants. It is expected that that notice will be given shortly after the Maxim company moves in, which it expects to do about the first of September. The change means that the business will be kept practically intact in Hartford. With the acquisition of the new property it will be possible to manufacture all the silencers in this city, with the exception of the marine or motor boat silencers, which are now being made by the Wilcox Crittendon Company at Middletown, Conn. The manufacture of silencers for guns, automobiles and stationary engines will stay in Hartford, as will the war contract department and Mr. Maxim's private experimental laboratory. The Maxim company employs about fifty hands and, since the beginning of the war, has been running at capacity. The lease for the new property runs for five years.

One of the greatest increases in the business has been in the manufacture of automobile silencers. In this department, it is all the company can do to meet the demand, and for 1916 President Hiram Percy Maxim is figuring upon making and delivering at least 100,000. Many of the orders are coming from European automobile truck makers, who wish their trucks equipped with silencers to use in the war.—T. C. W.

PROVIDENCE, R. I.

NOVEMBER 8, 1915.

The metal trades, and especially the machine tool builders, still continue to be as busy as they have been at any time during the past year, which, by the way, is establishing a record for this city along these lines. The agitation among the machinists is practically at an end, although the professional agitators remain here in their endeavors to precipitate a real strike that will effectually cripple the industry, but the workmen will have none of it, and practically all of those who desire work are busily engaged at their benches or machines, and the manufacturers have stopped worrying about what may happen to them in the future. Instead they are devoting their attention to getting out the orders that continue to come pouring in upon them.

The foundries of the State-brass and iron, are rushed to their capacity, and in several instances serious consideration is being taken as to the advisability of erecting additional facilities. Among the latter is the Newell Brass Foundry, at Central Falls, where the plant is being kept busy on a full time schedule, with a full complement of help and the orders piling up on the books.

For the first time in nearly a year it can be said of the manufacturing jewelry industry that there is a healthy activity which is causing a majority of the plants to be operated close to capacity. About two months ago business in jewelry—then virtually at a standstill, as it had been for several months—began to pick up. The cheaper grades of jewelry, as usual, experienced the demand first, and by degrees the improvement has spread to the better grades. Silverware production is less sensitive to trade depression than the jewelry business, and the present bookings with the silverware makers warrant the expectation of indefinite full-time operations.

A new shop for electroplating of jewelry and novelties is being fitted up at 19 Calender street, this city. The owner of the establishment is John Kafaf, formerly for several years, an employee of C. M. Robbins Company, at Attleboro, Mass.

The Atlas Sheet Metal Works, rear of 237 Dyer street is being operated by Gustaf T. Kollen, Charles Skoglund and Victor E. Blomquist, according to their statement filed at the city clerk's office.

Thomas I. Hudson, formerly of the Thomas I. Hudson Co. sheet metal and plumbers, has opened a store for similar business at 231 Cranston street.

Business at the plant of the Standard Nut and Bolt Company, Valley Falls, has increased to such an extent that it is necessary to maintain an overtime schedule, the works being kept running till 9 and 10 o'clock, three nights a week in order to fill the demands. At the plant it is said that the prospects for a continuance of the conditions are brighter than they have ever been before.—W. H. M.

BUFFALO, N. Y.

NOVEMBER 8, 1915.

Trade conditions in this city are much better than a year ago. Everywhere much confidence prevails concerning the future. Some even go as far as to say that they expect a boom. This they base on the increasing activity of the steel mills, munition factories, furniture factories, etc. These establishments they say are making additions and changes and this must affect the non-ferrous trade, they maintain. Also, the increase in wages for the "war order workers" means that they will start money to circulate more freely.

The foundries are unusually busy, as every foundry seems to be increasing its output. Some have even booked a sufficient number of orders to keep them busy throughout the winter months, and the less fortunate ones feel just as optimistic.

The Aluminum Casting Company reports that they have not been so busy in months, while the National Bronze Foundry reports that their prospects for the winter are very good. Fries & Co. have doubled their output during the past month.

A VIEW OF THE BRONZE TABLET (4 x 6 ft.) AS MADE BY THE NATIONAL BRONZE FOUNDRY FOR THE CITY WATER DEPARTMENT. THE VIEW SHOWS SOME OF THE FOUNDRY'S EMPLOYEES. MR. W. MARR, THE MANAGER, IS THE SECOND MAN FROM THE LEFT.

The Zero Valve and Brass Manufacturing Company have booked enough orders (not war orders) to keep their foundry busy on making pump parts until next May. They are the busiest founders and finishers in the city. In fact, at the present time they are working their forces every night until nine, in order to keep pace with the orders. During the past month they did all the brass rail work for the Geneva (N. Y.) Theatre and the Erie (Pa.) Theatre. At present they are working on a half-dozen similar jobs.

The Niagara Brass Manufacturing Company's foundry and finishing departments were damaged by fire during the past month to the extent of $15,000. It took the firemen several hours before they were able to extinguish the flames.

The Lumen Bearing Company are doing a great deal of automobile work.

The U. S. Hame Company have elected the following new directors for the coming year: Fred Frazer, Syracuse, N. Y.; W. S. Carr, Andover, N. H.; J. G. Rowell, Manchester, N. H.; J. A. DeArmond, Cincinnati, O.; C. F. Herrmann, Tell City, Ind.; H. J. Turner, W. C. Houck, R. P. Carr and Proctor Carr, of Buffalo, N. Y.

The general tendency of the finishing and rolling mill trade is to be more brisk. Everywhere evidence may be found that trade is much stronger. But a good share of this trade consists of war orders, all of which are marked "rush." Then take the platers. They have not been so busy as during the last month in nearly a year, and from many indications some of them will be exceedingly busy during the winter months. A. F. Flanders Manufacturing Company reports that business is picking up everywhere, while A. G. Fries reports the same. D. S. Day Manufacturing announce a steady increase of business throughout the country. —G. W. G.

NIAGARA FALLS, N. Y.

NOVEMBER 8, 1915.

The trade generally, in this market, cannot be said to have increased to any marked degree during the last month. Nevertheless, this market has a steady, healthy growth. Trade is spotty, but very much stronger. "And if the war continues," said one local dealer, "we will continue to increase our volume of business. But should it come to sudden stop, we will feel it very much. The end of this war is going to mean a slump in business for some months. Trade throughout the country is not healthy, except in the war order line, and as soon as this bottom falls out we are going to have a slump until we become adjusted to the new conditions. And then we are going to have a big boom in this country, such as we have never seen before."

In the plating trade there has been a slight dropping off of business, but the winter prospects are said to be good. Among the firms who have noticed an increase rather than a decrease are the Spirella Company and A. H. Wright.

In the jewelry, stamping and silverware trade, Elbe Manufacturing Company, Niagara Falls Metal Stamping Mill and the William A. Rogers Company, Limited, report a slight increase in business.

The Carborundum Company, who are unusually busy, are making a two-story addition to their plant No. 3, which will be equipped with 4 kilns, etc. Also, they recently bought the large plant of the Ozone Vanilla Company, which plant adjoined theirs, which is to be converted into a crushing, washing and grading plant. The machinery is now being installed. Both additions are to be ready for operation by the 15th of December.

The foundries continue to be as busy as last reported. The Frontier Brass Foundry reports that their business is better than it has been for the past two months.

The Titanium Alloy Manufacturing Company report that their ferro-carbon titanium department is becoming a very important one because of the increasing number of inquiries and orders. They are now occupying their additional office building which is equipped with a number of private offices, a technical library and study, a special room for their salesmen, also a dining room, kitchen and pantry. The dining room is for the exclusive use of the office force and foremen. They announce that George Powell is their new master mechanic.—G. W. G.

COLUMBUS, OHIO

NOVEMBER 8, 1915.

The metal market in Columbus and Central Ohio territory is holding up remarkably well in every way. The tone is better and future prospects are growing brighter as the season of expansion approaches. Prices are firmer and some slight advances have been recorded in certain metals. There are many more inquiries received indicating an upturn in manufacturing circles. War orders are one of the big features although there is a considerable absorption of metals in other lines. The supply is fairly easy except in the case of aluminum. There is considerable promotion of new concerns which will use considerable metals. In fact the metal industry is showing more new concerns than any other line of industry.

The brass market is firmer all along the line. Composition scrap is selling from 14 to 14 1-4 cents per pound. Copper is holding its own, being quoted at 17 to 17 1-4 cents per pound for cruciable shape. Aluminum is much stronger and the selling price in this territory is 50 cents. The supply is short. Zinc is unchanged from the previous month. Tin is weaker owing to larger stocks which have accumulated. Lead is firmer and the demand is steadily increasing. Babbitt is selling well while type metal is also in good demand.

Officials of the Atlas Brass Foundry Company announce that they are about ready to start the erection of a three-story machine shop addition to the present plant in South Part street. The company has found increasing business in the manufacture of automobile parts necessitates the enlargement, which will cost about $10,000. The force of 70 or 80 men, that is now working day and night, will be increased, it is said.

On account of increased business the need of larger quarters, the Shields Pattern Works has moved to a new and larger plant at 57 North Fourth street, where the concern will be in better position to take care of a growing business. The company makes models and patterns of every description for iron, brass, steel and aluminum, specailizing in patterns in wood and metal.—J.W.L.

DETROIT, MICH.

NOVEMBER 8, 1915.

Owing to the excellent condition of the automobile business and war contracts, the metal plants of this city are undergoing an unusual period of prosperity. The heavy demand for both pleasure and commercial cars is keeping the brass, copper and aluminum plants working to capacity to meet the demand for parts and accessories. The Ford Motor Company, Packard Motor Car Company, Cadillac Motor Car Company, Paige Motor Car Company, Studebaker Corporation, Chalmers Motor Company, Maxwell Motor Car Company and the plants of the General Motors Company here, are all busy, with no indication of a slowdown throughout the winter. Previously the automobile plants at this season of the year reduced their number of employees and were quiet until after the automobile shows in the latter part of the winter. There will be no lay-off this year and work will be plentiful until spring, and then the 1916 campaign will start which will keep the plants operating at high speed almost indefinitely.

The brass, copper and aluminum plants that have grabbed up war orders are attending strictly to business and giving employment to a large number of men. The Rowe Stephens Company is reported operating on a large war contract and is understood planning to extend its facilities. It has previously, and is at the present time, manufacturing plumbers' supplies.

It is reported that the American Enameled Magnet Wire Company of Muskegon, Mich., has closed a contract for 200,000 pounds of copper wire to be used in the manufacture of electric starters for automobiles. Fifty men have been added to its force.

It is learned the J. E. Bolles Iron & Wire Works is receiving an unusually large number of orders for South America, and business is so pressing that it is working to full capacity. It also is sending its ornamental productions in both brass and iron to all parts of the United States and Canada.

The American Lubricator Company, whose plant is at Summit street and the Wabash railway, is another Detroit concern that reports a large amount of business, with no prospect of a let-up in sight. This company does a great deal of jobbing work for automobile concerns, besides its general production of lubricators, oiling cups, priming cups, indicator cocks, etc.—F. J. H.

A steady and normal business is evident in all of the metal manufacturing plants in Detroit and not a single firm can be said to be slowing up in business. Some firms are booked with orders to cary them up to the first of January, 1916. The local metal market has been in a normal condition for the past two weeks and large orders have been placed with the local dealers which will enable some of the large consumers to carry them over to the first of the year. The shortage of freight cars to bring the raw material and take out the finished product has had the manufacturers pulling every string of the wires to get results, the demands here being greater than anywhere else owing to the thousands of automobiles which are dispatched to the ends of the land. The car shortage here indicates prosperity in other sections of the country, so there is some compensation in the disappointment at this time of the year.

The Canadian brass plants along the border have booked additional orders this past week for brass parts for high explosive

shells which will keep them busy for some time to come.

The Canadian plant of the Wolverine Brass Manufacturing Company, located at Chatham, Ont., has been rebuilt after the disastrous fire they had a few months ago, and are manufacturing some of their leading specialties. It has not been fully decided by the company whether they will make their entire line of goods or utilize part of their plant for manufacturing rubber or automobile specialties.

Barney Nehls Plating Works, located at 248 Brush Street, the oldest job plating shop in the city, are doing a good business on auto parts, hotel silverware and lighting fixtures.

The Detroit Ball Valve Company, located at 572-580 Franklin have some good orders on file for globe, angle and check valves.

The plumbing and steam brass goods manufacturers are doing a normal fall business.—P. W. B.

CINCINNATI, OHIO

November 8, 1915.

The labor situation in the machinery and related trades has been the most important factor during the past few weeks, although it is now believed that matters have been adjusted in such a manner as to make it probable that there will be no further trouble of consequence. It is true that men walked out in a number of large plants, and that in some cases there are still men on strike; but it is also true that most of the leading concerns are still running on full time, indicating that the threat of a tie-up has not injured them to any considerable extent. The principal issue between the men and their employers was the demand of the former for an eight-hour day without reduction of pay, and in virtually every case the employers, setting forth plainly their view of the situation, declared it to be impossible for them to meet the demand. The walkout resulted. At the bottom the real issue was the complete unionization of the Cincinnati machinery trade, the firm stand of the employers being largely based on the realization that this was the case; and it can be said that at this time they have the situation well in hand.

The humming activity attendant on the filling of heavy war orders continues to dominate all branches of the metal trades, from foundries to machine shops, and bids fair to do so for many months to come. That this is evident may be gathered from the fact that the greater part of the orders are guaranteed under bond, regardless of the outcome of recent rumors of an early peace. When it is considered that the domestic industrial situation gives every sign of reviving, bringing with it a normal internal demand for machinery, it can be understood that the trade is not regarding the future with anything resembling pessimism. The only consuming factor which is not in satisfactory shape is the distillery and brewing business, in which operations have virtually been suspended in Ohio, awaiting the outcome of the election on the proposed prohibitory amendment. —K. C. C.

LOUISVILLE, KY.

November 8, 1915.

During October the metal workers of Louisville noted a slight improvement in conditions. The annual distilling season is just about to open, and a good deal of repair work is now being distributed among the coppersmiths. There is very little new work to be had, although the outlook is considerably brighter and some new work may be handled next season. Special casting work is a little dull just now, and some of the smaller shops which specialize on pattern making, etc., are not particularly busy.

The coppersmiths and other metal working concerns of the state are looking forward with considerable interest to the 1916 meeting of the Kentucky legislature which convenes in January. From general indications there is not very much to fear from the prohibitionists at this meeting, although in 1914 the state came very close to going dry and such a disaster was barely averted.

The J. J. Reilly Manufacturing Company, large manufacturers of steam pumps and consumers of brass, recently filed amended articles of incorporation, changing the name of the concern to the Freville-Piatt Company and reducing the capital stock from $50,000 to $30,000. The amendment was signed by A. B. Freville, R. F. Piatt and B. H. Glasford, owners of more than two-thirds of the capital stock.

The Vendome Copper & Brass Works reports the completion of the last of a string of distillation plants which it handled in the Louisiana district. Kentucky distillery work is now opening up nicely, and a full force is being employed at the local shops. Repairs this season will be about the same as those of last year.

L. F. Garrity, an expert workman in precious metals, who for some years was foreman of the manufacturing department of the jobbing jewelry house of George Katzman & Company, recently purchased the manufacturing end of the business from the Katzman concern, and has established a new shop at 310 W. Jefferson street over the Shu Fit Company. The crucibles, machinery, benches and equipment were moved from the Katzman shop to the new location.

Hines & Ritchey report that the copper business is looking up, and that the concern is receiving numerous orders for small lots of repair work on distilleries. Some new work is in sight, but is being held up for the time being. The concern is very busy in its milk machinery manufacturing department where silver bronze is largely being used in place of brass in the manufacture of emulsifiers which are used in milk and drug machinery. This bronze is almost impervious to acid.

At Owensboro, Ky., the Hull Pump & Tank Company, consumers of brass and copper goods, recently filed articles of incorporation, listing its capital stock at $100,000. The incorporators are E. D. Hull, J. J. Trigg and J. W. McCulloch—G. D. C.

PHILADELPHIA, PA.

November 8, 1915.

The month just past has witnessed a very satisfactory improvement in the condition of the local metal and allied trades. This has been due, in a measure, to a revival in business conditions generally and specifically, to the great number of building operations that have been gotten under way during the present season. According to the statement of Commissioner Jackson, of the State Department of Labor and Industry, applications from manufacturers are pouring in daily for experienced metal workers, the supply being seemingly unequal to the demand in this respect.

The Merchant & Evans Company, which will next year celebrate its fiftieth anniversary as an important business interest in the manufacture of tin plate and metals, will on January 1, 1916, vacate its long-established quarters at 517 Arch street, to occupy an enlarged plant at 2019-35 Washington avenue. In explanation of this step, the company has issued a statement to the effect that it has outgrown its present office and warehouse and that a constantly expanding business has made imperative provisions for more extensive accommodations. In addition to this, a heavier and growing tonnage has required larger warehouse space and railroad terminal facilities. The new plant will have a floor area in excess of 75,000 square feet. —P. N. S.

TRENTON, N. J.

November 8, 1915.

The metal industry appears to be somewhat active at the present time and work appears to be plentiful in the majority of plants where metal is turned out. The manufacture of war munitions has given a boom to the industry here and as a result metal workers find conditions a little more prosperous. The winter promises to be a somewhat busy one, according to the management of the different factories. One of the busiest concerns in Trenton to-day is the Ingersoll-Trenton Watch Company. The demand in Europe for the Ingersoll timepieces has become so great that the Trenton concern will be compelled to enlarge its Monmouth street plant early next spring. More than half a million watches have been sold to the soldiers by the London office of the company during the first year of the war, and the monthly average of sales is now 75,000, or five times the normal total before the outbreak of hostilities. Before August 1 of last year the monthly sales through the London office averaged about 15,000, but more than a million watches have

been sold abroad since that time. It is estimated that about half of these timepieces went to the men in the trenches. Several of the departments of the Ingersoll plant are operating at night and the Waterbury, Conn., branch of the concern is also feeling the effects of the big European order. Experienced metal workers are in demand at the watch works and good wages are paid. The Ingersoll company has never had any labor difficulties during its many years here and the demands are always met by the company.

Work at the J. L. Mott plant has been delayed during the past month by another strike. This time the employees of the polishing department quit work after being informed that they would hereafter be employed on piecework instead of the regular day scale. The men saw that they would have to work harder for less money and they immediately filed a protest. The company announced that the order would stand, but after the employees had been out a few days the company revised the scale so they could earn more wages. There was also trouble among the 150 young men who were recently employed to assemble the time fuses the plant is turning out for the European nations. Although the young men are doing the same kind of work they did not receive the same wages and a strike was begun. The strike, however, lasted but a short time and the wage scale was adjusted.

The Trenton Brass and Machine Company finds business a little better. The company is manufacturing brass trimmings for closets for potteries. The field is a large one because of the fact that there are about fifty potteries and porcelain plants in this city. The company is also making brass fixtures such as window fasteners, latches and arm supports for trolley companies.

The De Laval Steam Turbine Company is busy turning out brass for various kinds of engines and motor pumps, of which the company makes a specialty. The company recently received an order for the manufacture of lathes from which gun barrels are to be made for the fighting nations. The Billingham Foundry and Machine Company has increased its working force during the past month and is paying good wages to brass finishers so as to have the material turned out on time. The Skillman Hardware Manufacturing Company is very busy and is turning out a big order for a jobbing house in Nebraska. Because of the fluctuations in the metal markets Manager William G. Wherry says that he will have to revise bids recently made on big contracts. The bids were asked before the price of copper and brass began to soar so high.

The National Electric Plating Company is holding its own without any additional help, but John W. Metz, president of the concern, says he believes business will pick up late in the fall. Work is brisk at the plant of the McFarland Foundry and Machine Company and also at the Trenton Smelting and Refining plant.

The American Ammunition Company has perfected plans for the erection of a large addition to its plant at Bordentown, N. J., near here. Work will be started soon on the plant, which will cost about $85,000. The company is a branch of the Standard Fuse Corporation, engaged in the manufacture of war material for the Allies. The contracts, which call for brass caps for shells, will keep the plant busy for at least two years. The American company's present plant is turning out various kinds of tools to be used in other factories where shells are made. About 400 persons will find work when the new plant is completed.—C. A. L.

NEWARK, N. J.

NOVEMBER 8, 1915.

While conditions are not staple and normal yet, they are constantly improving. The past month has seen a very decided advance toward good business, and the outlook is brighter than it has been for a long time before. While one can easily find dark spots in the situation if he looks for them, a comparison of the volume of business now with the volume of business a year ago, and the outlook now, with that of twelve months ago, cannot but convince one of the real progress that has been made. Collections, which have almost universally been reported bad, even where there was some movement in business, are now reported by many as letting up a little, though this feature of business has not improved as greatly as that of actual work. With the banks beginning to loan out money a little more freely, and the buying public beginning to pay up its accumulated debts and to buy more freely, the matter of collections will doubtless soon show much greater improvement. There is still a little lack of confidence on the part of a portion of the buying public as is evinced by the unusually large deposits that are being made in the savings banks and building and loan associations, but if conditions keep on improving for several months more it is likely that savings bank deposits will assume a more normal figure and that more of the wages of the public will get into trade, and so eventually to the manufacturers.

The unemployment problem is practically solved. Comparatively few who want work are now out of work. The improvement of conditions is marked among the manufacturing jewelers. The past year has been a lean one for them, and with but few exceptions they are all working practically full time now, and a number of concerns are working nights, though the number of employees is not up to what it was a few years ago. Some of the manufacturing jewelers would be glad to put on more help, but during the dull times many jewelers drifted into other lines and will not now come back. The other metal trades are doing better. Some materials are still high, making it hard to manufacture certain goods at a profit, and the increase cannot always be passed on, but taken as a whole, the metal factories of Newark are much busier than they were.

Two extensions are being erected to the chemical plant of the Butterworth-Judson Company at Avenue R and the Central Railroad. The new buildings will cost $14,000.

The plans of the Metals Plating Company, of New York City, for a new plant at Elizabeth, N. J., have been approved by the building inspector and the work will be started soon. The building is to be 236x40 feet.

The J. J. Jackson Company, roller of silver and other metals, at 156 Astor street, reports business is considerably better than it was.

The Newark Association of Credit Men, through its adjustment bureau, has just finished the administration of the estate of the H. S. Wyckoff Company, manufacturers of platers' supplies at 269-275 Broome street. A final dividend of four and seven-tenths per cent., following an earlier one of thirty per cent., has been forwarded to the creditors. The affairs of the Wyckoff Company were placed in the hands of the adjustment bureau on May 3 last, and all the creditors assented to the administration out of court by that body.

According to the year book which the Newark Board of Trade has just issued under the title "Newark, a Manufacturing City," Newark, which ranks fourteenth among the cities of the United States in point of size, is eleventh from the standpoint of manufactures. There are 252 distinct lines of industry in the city, and the weekly payroll is $1,000,000. The yearly output of the finished products amounts to $250,000,000. Newark is the largest manufacturing center in the country for fine jewelry.

Several jewelry firms and a badge and button company were burned out by a fire which partly destroyed the four-story brick factory building at 178-182 Emmett street, on Saturday, October 9. The loss was estimated at over $50,000. The cause is not known for certain, several theories having been advanced. The firms occupying the building, all of whose plants suffered damage, were the Orange Company, makers of badges and metal novelties; the A. J. Hedges Company, manufacturing jewelers; Schleckser & Wiegand, manufacturing jewelers, and Triesch & Schoenberg Company, manufacturers of jewelry and jewelers' fancy cases. All of the firms were busier than they had been for some time before. All were covered by insurance with the exception of Schleckser & Wiegand, who had allowed their policy to lapse.

Smith, Brannan and Strein, electroplaters, polishers, etc., 105 Oliver street, are very busy at the present time. Mr. Smith states that business seemed to come all in a rush, many of his firm's customers from whom they felt sure they would get work, holding off until the fall season had opened. Then the orders came in very rapidly. The outlook for a continuation of good business, at least for several months, is good.

The Aluminum Plated Ware Company, Market street, reports that business is improving and that the outlook is good.—R. B. M.

NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

The Metal Plating Company, 200 Fifth avenue, New York, N. Y., is contemplating the construction of a factory on North avenue, Elizabeth, N. J.

The Caskey Brass and Bronze Works, northwest corner of Richmond and York streets, Philadelphia, Pa., is erecting a brass foundry 50 x 90 feet.

The Atlantic Wire Company, Branford, Conn., is erecting a two-story, concrete factory, 45 x 300 feet, to cost $75,000, to be used for the manufacture of its specialties.

The Ohio Bronze Powder Company, Cleveland, Ohio, will establish a factory at 1115 East 152nd street for the manufacture of all grades of gold, bronze, and aluminum powders.

The new one-story, 50 x 70 foot building which the Pilling Brass Company, Watertown, Conn., is erecting, is nearly ready for occupancy. The company is installing four additional rolls.

The Milwaukee Die Casting Company, Milwaukee, Wis., have obtained a permit for the erection of a foundry and machine shop, 50 x 60 feet, to cost $12,000, at 297 Fourth street, Milwaukee, Wis.

The Warner Brothers Company, Bridgeport, Conn., has leased for three years the plant of the Nichols Underwear Company, New Milford, Conn., which will be used as a branch of the metal-working department of the Bridgeport factory.

The new factory which the Brown Instrument Company, Philadelphia, Pa., occupied a year ago has proven too small for growing business and the company has let a contract for the erection of an addition which will provide 50 per cent. additional floor space. This addition has been found necessary by a large demand for their high-temperature pyrometers.

The Thomas Davidson Manufacturing Company, Ltd., Montreal, Canada, manufacturer of enamelled ware, copper ware, wire goods, etc., is constructing a new addition to its factory at 187 Delisle street. This company operates the following departments: Brass foundry, spinning, stamping, galvanizing, polishing, plating and japanning departments.

The Birmingham Iron Foundry, of Derby, Conn., manufacturers of rolling mill machinery, report through M. P. Fillingham, of New York, their representative and engineer, that they are filling an order for a six-roll equipment for the Western Cartridge Company of Alton, Ill., and a four-roll equipment for J. B. Wise, of Watertown, N. Y. Reports are also out that the Standard Underground Cable Company of Perth Amboy, N. J., and the Waclark Wire Company of Elizabeth, N. J., have greatly increased their capacity.

The transfer of a large American aluminum plant from foreign to American ownership is announced in press reports from Charlotte, N. C. French interests operating as the Southern Aluminum Company, were active throughout the greater part of 1914 in pushing extensive operations at the Narrows of Yadkin River, near Whitney and Badin, Stanley County, N. C., but as a result of the European war the development of the property stopped and was expected to be at a standstill for an indefinite period. In buying the plant the Aluminum Company of America, with headquarters at Pittsburgh, Pa., announces that the development work will be resumed, and that the plans of the original designers will be carried out with only slight modifications.—Commerce Report, November 4, 1915.

Due to the tremendous demand for cartridge metal a great activity is noticed in the manufacture of brass mill machinery. Practically all of the great brass mills have increased their equipment, while on the other hand some new mills are being installed by concerns who have not heretofore manufactured this class of product. For instance, a concern making milk cans in the West has gone into the manufacture of three-inch brass cartridge shells, while another Western plant now rolling copper is rapidly preparing to roll sheet brass.

On October first the property and business of the E. I. du Pont de Nemours Powder Company of New Jersey was sold and transferred to the E. I. du Pont de Nemours & Company of Delaware, a corporation organized for the purpose of taking over and carrying on the business. The new company assumes all liabilities of the old company, except capital stock and funded debt, and will carry out all contracts of the old company, there being no change in the personnel of the management, operations or methods of handling the business. The company will issue capital stock to the amount of $120,000,000.

The Superior Jury of Awards at the Panama-Pacific International Exposition, San Francisco, has awarded a Grand Prize to the Nonpareil heat insulating materials for general excellence. These materials are manufactured by the Armstrong Cork & Insulation Company, Pittsburgh, Pa., and include Nonpareil insulating brick for industrial furnaces, ovens, boiler settings, kilns, etc.; Nonpareil high pressure steam covering for high pressure and superheated steam lines, feed water heaters, etc.; Nonpareil cork covering for drinking water systems, brine and ammonia lines and all cold pipes, and Nonpareil corkboard for cold storage rooms. These materials were described in THE METAL INDUSTRY for September, 1914.

REMOVALS

J. Hughes, Boston, Mass., announces that on or about November 1 he would remove his metal spinning business from 40 Hanover street to 77 Travers street, Boston.

The Philadelphia office of the Aluminum Company of America, Herman H. Helms, manager, has been moved from the Pennsylvania Building to 1216-1218 Widener Building.

The Cleveland Blow Pipe & Manufacturing Company, Cleveland, Ohio, has moved its plant from 2096 West Third street to 6302 Kinsman Road, where they have double factory space and increased efficiency for the manufacture of their dust collectors, ventilating systems, sheet metal guards and general sheet metal work.

NEW OFFICERS

At a meeting of the board of directors of the Hanson and Van Winkle Company, Newark, N. J., held November 3, 1915, the following new officers were elected: President, E. N. Todd; vice-president, R. D. Foster; treasurer, E. N. Boice; secretary, W. L. D. Bedell. M. A. Johnson, Jr., is credit department manager.

INCORPORATIONS

Business organizations incorporated recently. In addressing them it is advisable to include also the names of the incorporators and their residence. Particulars of additional incorporations may frequently be found in the "Trade News" columns.

To manufacture bronze, etc.—Sanders Process Company, Willard avenue, Garfield, N. J. Capital $500,000. Incorporators: Carleton E. Sanders, Paul C. Hough and George T. Jacobs.

To manufacture electrical apparatus.—Waterbury Metal Wares Company, Waterbury, Conn. Capital, $50,000. Incorporators: L. W. Andersen, president; B. S. Fenton, treasurer, and E. A. Godfrey, secretary.

To manufacture and sell aluminum products.—Akron Aluminum Company, Akron, Ohio. Capital, $10,000. Incorporators: W. C. Washburn, Geo. G. Andrews, H. W. Heckman, John Dildine and Lena B. Washburn.

To manufacture aluminum and other metallic compounds.—The Victor Aluminum Manufacturing Company, Wellsville, N. Y. Capital, $150,000. Incorporators: F. L. Rockwell, W. E. Browning and J. L. Rockwell

To manufacture galvanized steel and brass hose clamps.—H. F. Schivier Manufacturing Company, Detroit, Mich. Capital, $10,000. Incorporators: Henry F. Schivier, William J. Tyler and Floyd B. Meisenheimer.

To manufacture metal novelties.—The Royal Manufacturing Company, Chicago, Ill. Capital, $50,000. Incorporators: Joseph Salomon, Johanna K. Salomon and Max Klee. The company will include among their various departments spinning, stamping, brazing, plating, polishing and japanning.

BUSINESS TROUBLES

A voluntary petition in bankruptcy was filed on October 16, last, in the Newark Branch of the United States District Court, by John O. Pierson, proprietor of the brass foundry at 147 New Jersey Railroad avenue, Newark, N. J. Mr. Pierson estimates his assets at about $2,000 more than his liabilities. Included in his listed assets, however, are two inurance policies aggregating $1,650. The value of the stock in the brass foundry is estimated at $1,500. The case has been referred to Referee Charles M. Mason for settlement.

INCREASE IN CAPITAL STOCK

The Aetna Brass Manufacturing Company of Cleveland, Ohio, has increased its capital stock from $10,000 to $100,000.

The Cuyahoga Stamping and Machine Company, Cleveland, Ohio, has increased its capital stock from $1,000 to $125,000.

DECREASE IN CAPITAL STOCK

The National Enameling and Manufacturing Company, Youngstown, Ohio, has decreased its capital from $100,000 to $1,000.

INQUIRIES AND OPPORTUNITIES

Under the directory of "Trade Wants" (published each month in the rear advertising pages), will be found a number of inquiries and opportunities which, if followed up, are a means of securing business. Our "Trade Want Directory" fills wants of all kinds, assists in the buying and selling of metals, machinery, foundry and platers' supplies, procures positions and secures capable assistants. See Want Ad. pages.

PRINTED MATTER

Presses.—The Boomer & Boschert Press Company, Syracuse, N. Y., have issued catalog No. 41, which is devoted to the extremely varied line of presses which they manufacture, which include knuckle joint, power screw and hydraulic presses and a long list of other special presses. Copies of the catalog may be had upon request.

Molding Machines.—The Moldar Company, of Maspeth, N. Y., have issued a catalog giving illustrations and descriptions of their line of molding machines which, it is claimed, are "short-cuts to good castings." This line of foundry machinery includes a molding machine, roller-ramming machine and sand-handling appliance. Further information may be obtained from the above company.

Year Book.—The Merchants' Association of New York have issued their 1915 Year Book, which consists of a well-put-together volume of 240 pages. Complete reports of the activity of this association, whose object is "To Foster the Trade and Welfare of New York," for the past year are set forth in the book, and there is also contained therein an alphabetical list of members, which now includes over thirty-four hundred.

Metal Cleaner.—The James H. Stitt Company, New York, N. Y., have quite a little to say in a small booklet about the new metal cleaner which they call "Stittine." This material, it is claimed, will not tarnish or stain the metal, throws off no fumes and removes all grease of oil from all metal and will not injure the hands. A complete line of grinding and polishing machines is shown by sample at the office of the company at 185 Madison avenue.

Welding.—The Modern Engineering Company, of St. Louis, Mo., have published an interesting folder devoted to welding and cutting with the Meco oxy-acetylene welding apparatus which they manufacture. The various advantages of the Meco torch, which is covered by patents, are set forth under the heads of Safety, Strength and Durability and Service. The folder also contains numerous illustrations of the various types of apparatus handled by this company. Copies may be had upon request.

Thermit.—The Goldschmidt Thermit Company, New York, N. Y., have issued a very valuable catalog of seventy-eight pages under the title of "Thermit Mill and Foundry Practice." This book gives full instructions for, together with illustrations of, all kinds of welding, not excepting the most difficult jobs. The catalog should be of extreme interest to all users of machinery likely to need welding repairs. This company also produces a number of carbon free metals and alloys, such as manganese-copper, manganese-titanium, etc., information relating to same which are contained in pamphlet No. 20.

Crucible Care.—A very serviceable and attractive card has been issued by the Joseph Dixon Crucible Company, Jersey City, N. J., which should be of particular interest to every user of crucibles. One side of the card, which is of stiff cardboard suitable for hanging up and which is 7 by 9¼ inches in size, contains a number of very important instructions relating to the use of crucibles in order to increase capacities and heats. The obverse side of the card contains a table of specific gravity and melting points of the more commonly used metals and alloys. Copies of this card may be had by addressing the Joseph Dixon Company.

Metals.—The Titanium Alloys Manufacturing Company, Niagara Falls, N. Y., have issued a very interesting pamphlet called "Titanium Aluminum and Other Standard Bronze Castings." It shows that much care and patience were exercised in its make-up. In it a brief description, both chemical and physical, is given of Alloys Numbers 1, 3, 5, 9, 10, 11, 14, 15, 18, 19, 24, 28, 29, 32 and 33. Each is illustrated with two microscopic photographs. In fact, the Leflax Filling Index System Company, of Philadelphia, thought so much of the booklet that they made a brief review of the alloys, which was sent to all of their subscribers. This list of alloys is only a few of many they make.

Plating.—The Department of Mines of Canada have issued Part III, "Electro-Plating with Cobalt," which has been written by Herbert T. Kalmus, assisted by C. H. Harper and W. L. Savell. This pamphlet of 70 pages contains a full report of the researches of cobalt and cobalt alloys which have been conducted at Queens University, Kingston, Ontario, for the Department of Mines. Some very valuable information relating to the electro-deposition of cobalt is contained in the work and will be found of considerable interest to any one who is thinking of using the metal cobalt either in place of or in connection with nickel as an electro deposit. Copies of this pamphlet may be had by applying to the Canadian Department of Mines, and asking for No. 334.

FOREIGN TRADE OPPORTUNITIES

For addresses of these enquiries apply to Bureau of Foreign and Domestic Commerce, Washington, D. C., and give file numbers.

Stamped Metal and Wire Novelties, No. 19017.—An American consular officer in India reports that a firm in his district desires to be supplied with catalogs, price lists and terms of sole agency for the sale of stamped metal and wire.

Brass Strips, No. 19048.—An American consular officer in the United Kingdom reports that a man in his district desires to be placed in touch with American manufacturers of rolled brass strips, rolled polished brass strips, and rolled engraving brass strips, 6 to 18 inches wide, and from 12 to 20 feet long, suitable for use in making name plates, memorial brasses, stencils, and stamps and dies, etc. The gauge should be B. W. 8 to 22. Prices should be in British currency. References are given.

Zinc Plates, Pyrolusite and Graphite, No. 19097.—A business man in Norway desires to communicate with American manufacturers and exporters of zinc plates, No. 12, 0.65 mm. thick; No. 7, 0.35 mm. thick, or No. 6, 0.3 mm. thick; corrugated zinc plates for use on washboards, No. 7, plates to be 1 by 2½ meters; pyrolusite containing 90 to 95 per cent. oxygen; and pulverized graphite, free from iron and other particles. Quotations are desired c. i. f. destination.

CATALOG EXHIBIT

An exhibition of every kind of catalog may be seen at The Metal Industry office, 99 John street, New York. The Metal Industry is prepared to do all of the work necessary for the making of catalogs, pamphlets, circulars and other printed matter. Estimates will be furnished for writing descriptions, making engravings, printing, binding, for the entire job from beginning to end or any part of it.

METAL MARKET REVIEW

NEW YORK, November 8, 1915.

COPPER.

The price of copper during October has been held very steady at around 17¾ to 18 cents. Early in the month the large producers advanced their prices to 18¼ delivered terms; the demand was not very active, and instead of rushing in and paying the advance, that was not in any way justified, consumers held off and the price gradually sagged off to 17¾ delivered terms. This was a decline of ½ cent per pound from the artificial price of the copper combine. During the last few days of October the London market improved and prices here were pushed to 18 cents. On this last advance quite a heavy tonnage of copper was sold to consumers for the first six months of next year at from 17¾ to 17.90 on the regular delivered terms. Copper in England is being sent over here to be refined and to be re-shipped back to England. Instead of coming over here and paying fancy prices, England is inclined to use her own stocks. Later on, perhaps, she may have to come in and buy, but it is just as well to remember that copper at 18 cents a pound is artificially high and also that the consumption of copper today is just about at its greatest possible maximum and the large producers here must be carrying enormous stocks.

Prices today are around 18¼ cents for Electrolytic and Lake, and 17¾ for casting brands.

TIN.

The price of tin has only fluctuated about 2 cents per pound during the month although there has been talk of an export duty to be placed on tin by the British Government. There is so much red tape around all tin transactions it is almost impossible to start any speculative movements in this article today.

The market opened at around 32¼ cents and closed at 34¾. On November 1 the London market advanced sharply over £4 per ton and this put prices here up to 36½ cents.

LEAD.

The lead trust advanced the price of lead $8 per ton during the month of October, from 4½ October 1 to 4.90 New York basis at the close. The price seems to have been manipulated for the benefit of the trust, but of course that's what it's there for. The price of lead today is 4.90 New York and 4.82½ East St. Louis. November 4 the trust advanced the price 10 points to 5 cents New York, 4.92½ East St. Louis.

SPELTER.

The price of spelter has held firm all the month at from 14¼ to 14¾ cents per pound. The market is strong at the close at around 15½ cents.

ANTIMONY.

The antimony market has been quite active and prices have advanced about 8 cents per pound from around 28 cents at the opening to 36 cents, the highest point for the month, and 35.50 at the close.

ALUMINUM.

No. 1 virgin aluminum is very scarce and is worth about 60 cents, the 98-99 pure is obtainable at around 56 cents, and the No. 12 remelt alloy at 47 to 48 cents.

SILVER.

The silver market has been very quiet at around 48⅞ the low to 49⅜ cents at the close.

QUICKSILVER.

The market has held steady at around $92 per flask; at the close the leading interest is quoting $100. Spot stocks are very scarce owing to a delayed shipment, and dealers and jobbers who are without supplies are having a hard time to make deliveries. Small lots are quoted at $105 to $110 per flask.

PLATINUM.

The market holds very firm owing to a very limited supply. Ordinary refined is quoted at $50 to $55 per ounce and 10 per cent. hard at from $55 to $60.

SHEET METALS.

The nominal quotation for sheet copper was advanced ½ cent to 23½ cents and 27 to 27.50 for high sheet brass. Copper wire 19¼ base.

OLD METALS.

The old metal market has been fairly active. Copper scrap has been firmly held and prices are inclined to be higher. Aluminum scrap is in good demand and prices are decidedly higher. Clean aluminum sheets scrap is worth about 48 cents per pound and clean aluminum cable wire is in demand at around 52 to 53 cents.

OCTOBER MOVEMENTS IN METALS

COPPER,	Highest.	Lowest.	Closing.
Lake	18.25	17.75	18.25
Electrolytic	18.15	17.65	18.00
Casing	17.70	17.25	17.75
TIN	34.80	32.25	34.75
LEAD	4.90	4.50	4.90
SPELTER	14.75	14.25	14.55
ANTIMONY (Chinese and Jap)	36.00	28.50	35.75
SILVER	49¾	48⅞	49⅜

WATERBURY AVERAGE

The average prices of Lake Copper and Brass Mill Spelter per pound as determined monthly at Waterbury, Conn.:

1913—Average for year, 15.83. 1914—Average for year, 13.91. 1915—January, 14⅛. February, 15.25. March, 15.75. April, 18.50. May, 22.50. June, 22.50. July, 22.25. August, 19.50. September, 18.50. October, 18.25.

Brass Mill Spelter. 1915—January, 6.55; February, 11.85; March, 12.15. April, 13.85. May, 20.55. June, 25.60. July, 24.90. August, 19.30. September, 17.85. October, 16.85.

Metal Prices, November 8, 1915

NEW METALS.

	Price per lb. Cents.
COPPER—DUTY FREE. PLATE, BAR, INGOT AND OLD COPPER. Manufactured 5 per centum.	
Lake, carload lots, nominal	18.25
Electrolytic, carload lots	18.25
Casting, carload lots	17.75
TIN—Duty Free.	
Straits of Malacca, carload lots	36.50
LEAD—Duty Pig, Bars and Old, 25%; pipe and sheets, 20%. Pig lead, carload lots	5.00
SPELTER—Duty 15%.	
Brass Special	16.50
Prime Western, carload lots, nominal	15.50
ALUMINUM—Duty Crude, 2c. per lb. Plates, sheets, bars and rods, 3½c. per lb.	
Small lots, f. o. b. factory	70.00
100 lb. lots, f. o. b. factory	65.00
Ton lots, f. o. b. factory	60.00
ANTIMONY—Duty 10 per centum.	
Cookson's cask lots, nominal	....
Hallett's cask lots, nominal	....
Hungarian grade	35.50 to 36.00
NICKEL—Duty Ingot, 10%. Sheet, strip and wire 20% ad. valorem.	
Shot, Plaquettes, Ingots. Blocks according to quantity, nominal	48.00 to 50.00
ELECTROLYTIC—3 cents per pound extra.	
MANGANESE METAL	nominal
MAGNESIUM METAL—Duty 25% ad valorem (100 lb. lots)	6.00
BISMUTH—Duty free	nominal
CADMIUM—Duty free	nominal 1.90
CHROMIUM METAL—Duty free	.75
COBALT—97% pure	2.00
QUICKSILVER—Duty, 10% per flask of 75 pounds	105.00
GOLD—Duty free	$20.67
PLATINUM—Duty free	$50.00 to 55.00
SILVER—Government assay—Duty free	50

INGOT METALS.

	Price per lb. Cents.
Silicon Copper, 10% ... according to quantity	28 to 30
Silicon Copper, 20% ... " "	33 to 35
Silicon Copper, 30% guaranteed " "	36 to 40
Phosphor Copper, guaranteed 15% " "	23 to 27
Phosphor Copper, guaranteed 10% " "	21½ to 25¼
Manganese Copper, 30%, 2% Iron " "	24 to 28
Phosphor Tin, guaranteed 5% .. " "	58 to 61
Phosphor Tin, no guarantee .... " "	38 to 41
Brass Ingot, Yellow ... " "	12 to 15
Brass Ingot, Red ... " "	15 to 16½
Bronze Ingot ... " "	16½ to 17½
Manganese Bronze Ingots ... " "	23 to 24½
Phosphor Bronze ... " "	18 to 19½
Casting Aluminum Alloys ... " "	45 to 50

PHOSPHORUS—Duty free.
According to quantity ... 30 to 35

OLD METALS.

Dealers' Buying Prices. Cents per lb.		Dealers' Selling Prices. Cents per lb.
15.00 to 15.50	Heavy Cut Copper	16.50 to 17.00
14.50 to 15.00	Copper Wire	16.00 to 16.50
13.00 to 13.50	Light Copper	14.50 to 15.00
11.75 to 12.25	Heavy Mach. Comp	13.50 to 14.00
10.00 to 10.50	Heavy Brass	12.00 to 12.50
8.25 to 8.75	Light Brass	10.00 to 10.50
11.50 to 12.00	No. 1 Yellow Brass Turnings	13.00 to 13.50
10.50 to 11.00	No. 1 Comp. Turnings	11.50 to 12.00
4.00 to	Heavy Lead	.... to 4.25
10.00 to	Zinc Srap	.... to 11.00
15.00 to 20.00	Scrap Aluminum Turnings	20.00 to 24.00
25.00 to 30.00	Scrap Aluminum, cast alloyed	30.00 to 35.00
30.00 to 35.00	Scrap Aluminum, sheet (new)	35.00 to 40.00
23.00 to 24.00	No. 1 Pewter	25.00 to 26.00
20.00 to 26.00	Old Nickel	20.00 to 26.00

PRICES OF SHEET COPPER.

BASE PRICE, 23½ Cents per Lb. Net.

Width.	LENGTH.	64 oz. and over.	32 oz. to 64 oz.	24 oz. up to 32 oz.	16 oz. up to 24 oz.	15 oz.	14 oz.	13 oz.	12 oz.	11 oz.
		Extras in Cents per Pound for Sizes and Weights Other than Base.								
Not wider than 30 ins.	Not longer than 72 inches.	Base	Base	Base	Base	½	1	1½	2	2½
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	½	1	2	3	4½
	Longer than 96 inches. Not longer than 120 inches.	"	"	½	1	2	3	5	7	
	Longer than 120 ins.	"	"	1	1½					
Wider than 30 ins., but not wider than 36 inches.	Not longer than 72 inches.	"	"	Base	Base	1	2	3	4	6
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	1	2	4	6	8
	Longer than 96 inches. Not longer than 120 inches.	"	"	1	2	3	4			
	Longer than 120 inches.	"	1	2	3					
Wider than 36 ins., but not wider than 48 inches.	Not longer than 72 inches.	"	Base	1	2	3	4	6	8	9
	Longer than 72 inches. Not longer than 96 inches.	"	"	1	3	4	5	7	9	
	Longer than 96 inches. Not longer than 120 inches.	"	"	2	4	6	9			
	Longer than 120 inches.	"	1	3	6					
Wider than 48 ins., but not wider than 60 inches.	Not longer than 72 inches.	"	Base	1	3	5	7	9	11	
	Longer than 72 inches. Not longer than 96 inches.	"	"	2	4	7	10			
	Longer than 96 inches. Not longer than 120 inches.	"	1	3	6					
	Longer than 120 inches.	1	2	4	8					
Wider than 60 ins., but not wider than 72 ins.	Not longer than 96 inches.	Base	1	3	8					
	Longer than 96 inches. Not longer than 120 inches.	"	2	5	10					
	Longer than 120 inches.	1	3	8						
Wider than 72 ins., but not wider than 108 ins.	Not longer than 96 inches.	1	3	6						
	Longer than 96 inches. Not longer than 120 inches.	2	4	7						
	Not longer than 120 inches.	3	5	9						
Wider than 108 ins., but not wider than 120 ins.	Not longer than 120 inches.	4	6							

The longest dimension in any sheet shall be considered as its length.

CIRCLES, 8 IN. DIAMETER AND LARGER, SEGMENTS AND PATTERN SHEETS, advance per pound over prices of Sheet Copper required to cut them from ... 8c.

CIRCLES LESS THAN 8 IN. DIAMETER, advance per pound over prices of Sheet Copper required to cut them from ... 5c.

COLD OR HARD ROLLED COPPER, 14 oz. per square foot and heavier, advance per pound over foregoing prices ... 1c.

COLD OR HARD ROLLED COPPER, lighter than 14 oz. per square foot, advance per pound over foregoing prices ... 2c.

COLD ROLLED ANNEALED COPPER, the same price as Cold Rolled Copper.

ALL POLISHED COPPER, 20 in. wide and under, advance per square foot over the price of Cold Rolled Copper ... 1c.

ALL POLISHED COPPER, over 20 in. wide, advance per square foot over the price of Cold Rolled Copper ... 2c.

For Polishing both sides, double the above price.

The Polishing extra for Circles and Segments to be charged on the full size of the sheet from which they are cut.

COLD ROLLED COPPER, prepared suitable for polishing, same prices and extras as Polished Copper.

ALL PLANISHED COPPER, advance per square foot over the prices for Polished Copper ... 1c.

ZINC— Duty, sheet, 15%.

	Cents per lb.
Carload lots, standard sizes and gauges, at mill ... 16½ cent basis, less 8%	
Casks, jobbers' prices	17
Open casks, jobbers' prices	18

Metal Prices, November 8, 1915

PRICES ON BRASS MATERIAL—MILL SHIPMENTS.

In effect July 2, 1915

To customers who buy over 5,000 lbs. per year.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.26⅜	$0.26½	$0.26⅞
Wire	.26¾	.27	.27⅛
Rod	.26⅜	.27	.27⅛
Brazed tubing	.30⅜	—	.33½
Open seam tubing	.30¾	—	.33½
Angles and channels	.30¾	—	.33½

To customers who buy 5,000 lbs. or less per year.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.28½	$0.28½	$0.28⅝
Wire	.28½	.29	.29⅝
Rod	.28⅝	.29	.30
Brazed tubing	.32¼	—	.35½
Open seam tubing	.32¼	—	.35½
Angles and channels	.32¼	—	.35½

[Note.—Net extras for quality for both sections of above metal prices are not quoted due to the fluctuations in the price of zinc.—Ed.]

BARE COPPER WIRE—CARLOAD LOTS.

19¼c. per lb. base.

SOLDERING COPPERS.

300 lbs. and over in one order	22½c.	per lb. base
100 lbs. to 300 lbs. in one order	23c.	" " "
Less than 100 lbs. in one order	24½c.	" " "

PRICES FOR SEAMLESS BRASS AND COPPER TUBING.

From 1¼ to 3⅛ O. D. Nos. 4 to 13 Stubs' Gauge, 32½c. per lb.
Seamless Copper Tubing, 30½c. per lb.

For other sizes see Manufacturers' List.

PRICES FOR SEAMLESS BRASS TUBING Iron Pipe Sizes.

Iron pipe sizes with price per pound.

⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6
40½	39½	34½	33½	32½	32½	32½	32½	32½	32½	32½	33½	34½	36½	38½	39½

PRICE LIST OF IRON LINED TUBING—NOT POLISHED.

	Per 100 feet	
	Brass.	Bronze.
¾ inch	$8	$9
½ inch	8	9
⅝ inch	10	11
¾ inch	12	13
⅞ inch	14	15
1 inch	18	20
1¼ inch	22	24
1½ inch	25	27
1½ inch	32	35
1¾ inch	45	48
2 inch	56	60

Discount, 10%.

PRICE FOR TOBIN BRONZE AND MUNTZ METAL.

Tobin Bronze Rod	34c.	net base
Munts or Yellow Metal Sheathing (14" x 48")	30½c.	" "
" " " " Rectangular sheets other than Sheathing	32c.	" "
" " " " Rod	30½c.	" "

Above are for 100 lbs. or more in one order.

PLATERS' METALS.

Platers' bar in the rough, 38½c. net.

German silver platers' bars dependent on the percentage of nickel, quantity and general character of the order.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturer.

PRICES FOR SHEET BLOCK TIN AND BRITANNIA METAL.

Sheet Block Tin—18" wide or less. No. 26 B. & S. Gauge or thicker. 100 lbs. or more 5c. over Pig Tin. 50 to 100 lbs. 6c. over, 25 to 50 lbs. 8c. over, less than 25 lbs. 10c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 4c. over Pig Tin. 50 to 100 lbs. 5c. over, 25 to 50 lbs. 7c. over, less 25 lbs. 9c. over.

Above prices f. o. b. mill.

Prices on wider or thinner metal on request.

PRICE SHEET FOR SHEET ALUMINUM—B. & S. Gauge.

Gauge.	Width. Inches.	Less than 1 ton.	50 to 2,000 lbs.	Less than 50 lbs.
20 and heavier	3-30			
	30-60			
21 to 24 inclusive	30-48			
	48-60			
25 to 26	3-30			
	30-48			
27	3-30			
	30-48			
28	3-30			
	30-48			
29	3-30			
	30-48			
30	3-30			

We are unable to quote these prices, but they can be had upon application to manufacturers and dealers.

The above prices refer to lengths between 2 and 8 feet. Prices furnished by the manufacturers for wider and narrower sheet. No charge for boxing. F. O. B. Mill.

PRICE LIST SEAMLESS ALUMINUM TUBING.

STUBS' GAUGE THE STANDARD. SIZES CARRIED IN STOCK.

Outside Diameters.

Stubs' Gauge. Inches.	¼ in.	5-16 in.	⅜ in.	½ in.	⅝ in.	¾ in.	⅞ in.	1 in.	1¼ ins.	1½ ins.	1¾ ins.	2 in.	2½ ins.	3 ins.	3½ ins.	4 ins.	4½ ins.
11. .120.																	
12. .109.																	
14. .083.																	
16. .065.																	
18. .049.																	
20. .035.																	
21. .032.																	
22. .028.																	
24. .022.																	

We are unable to quote these prices, but they can be had on application to manufacturers and dealers.

Prices are for ten or more pounds at one time. For prices on sizes not carried in stock send for Manufacturers' List.

PRICE LIST FOR ALUMINUM ROD AND WIRE.

We are unable to quote these prices.

BASE PRICE GRADE "B" GERMAN SILVER SHEET METAL.

Quality.	Net per lb.	Quality.	Net per lb.
5%	34c.	16%	38c.
8%	35½c.	18%	38½c.
10%	36c.	20%	41c.
12%	37c.	25%	49c.
15%	37½c.	30%	54c.

GERMAN SILVER WIRE.

Quality.	Net per lb.	Quality.	Net per lb.
5%	36c.	15%	42⅝c.
8%	38c.	16%	43⅛c.
10%	39¼c.	18%	45⅛c.
12%	41¼c.	30%	60½c.

The above Base Prices are subject to additions for extras as per lists printed in Brass Manufacturers' Price List and from such extras 50% discount will be allowed. The above base prices and discounts are named only to wholesale buyers who purchase in good quantities. Prices on small lots are considerably higher.

PRICES OF SHEET SILVER.

Rolled sterling silver .925 fine is sold according to gauge quantity and market conditions. No fixed quotations can be given, as prices range from 1c. below to 4c. above the price of bullion.

Rolled silver anodes .999 fine are quoted at 2½c. to 3½c. above the price of bullion.